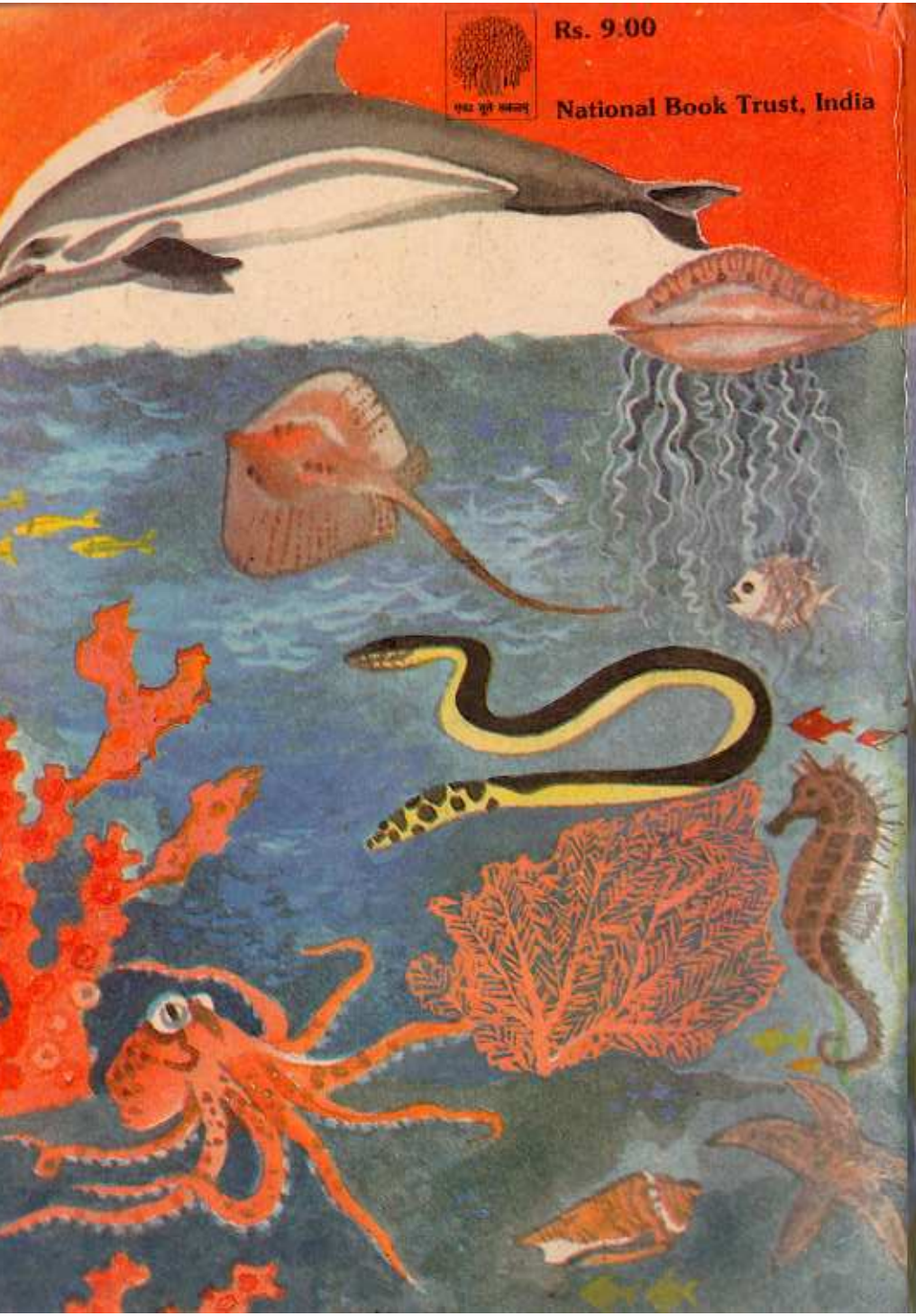

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Wonder World Under Water

B.F. Chhapgar

Cuttlefish

Nehru Bal Pustakalaya

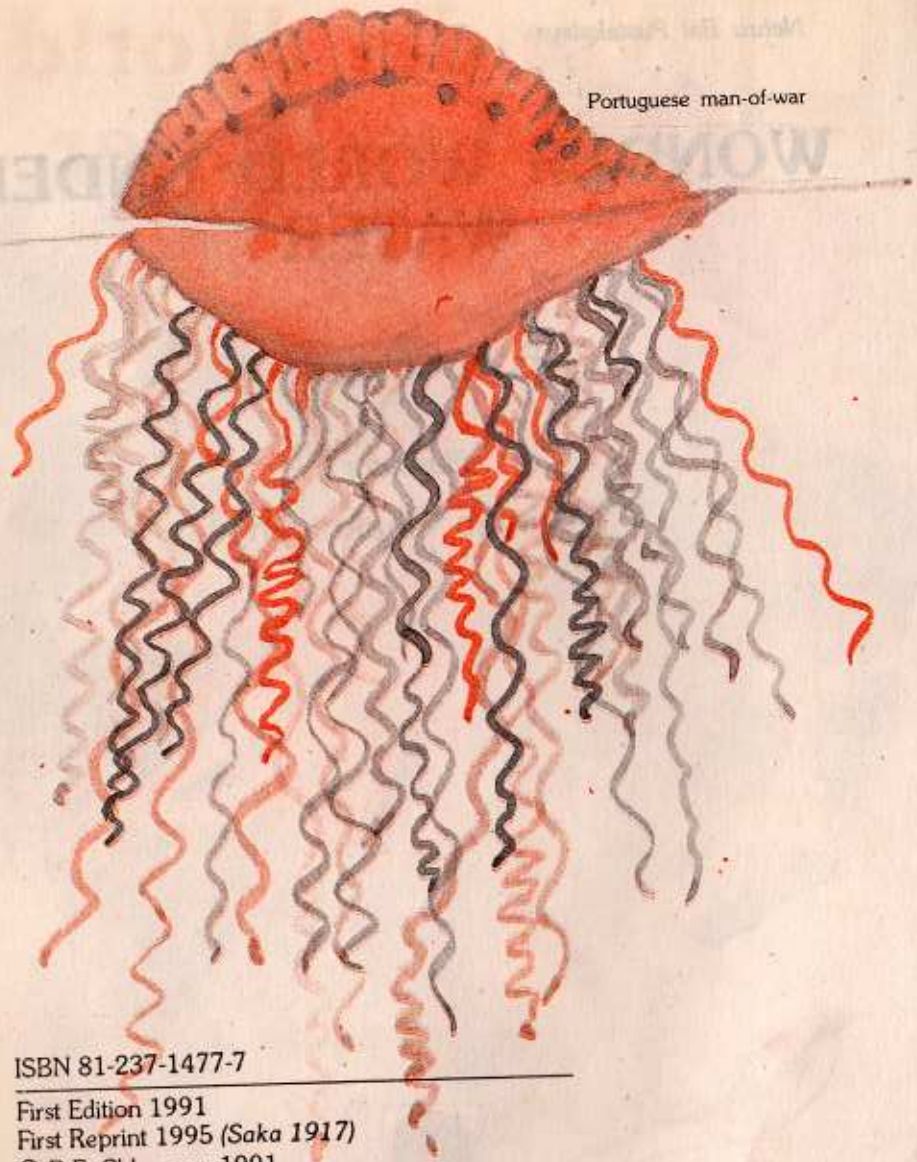
WONDER WORLD UNDER WATER

B.F. Chhapgar

Illustrator

Pranab Chakravarti

National Book Trust, India



Portuguese man-of-war

ISBN 81-237-1477-7

First Edition 1991
First Reprint 1995 *(Saka 1917)*
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Rs. 9.00

Published by the Director, National Book Trust, India
A-5, Green Park, New Delhi-110 016

Wonder World Under Water

Nearly three-quarters of our earth is covered by water. Yet we, living on land, usually know more about land creatures than our aquatic denizens. We have many kinds of watery environments, from the fast, clear, cold streams of the Himalaya to the placid rivers of the plains, and natural as well as man-made lakes and ponds. Moreover, we have a long coastline of some 5,600 kilometres, where live creatures so strange and fantastic that it is difficult to believe that such beings exist.

Aquatic life has had to make various adaptations in order to live successfully under water. Some creatures have made minimal changes; for example, the insect *Halobates*, which is found hundreds of kilometres away from the shore walking on the sea surface, looks very much like a land insect and breathes air. In contrast, there are others, like sponges or starfish, which do not have any representatives on land.

One of the first changes necessary for aquatic life is in the manner of breathing. While land animals breathe by means of lungs, aquatic animals normally use gills, though some fishes have developed organs which function like lungs and enable them to breathe air directly from the water surface.

The body fluid of sea-water fishes is less salty than the sea-water as fishes living there are continually losing water through their skin and gills. (Water always moves from a weak solution to a stronger one.) To make up for this loss they must keep drinking water. In the case of freshwater fishes, however, their body fluids are stronger than the surrounding water and so they are continually soaking up extra water. They have well developed kidneys which help get rid of the excess water.

Animals (and plants) are heavier than water, so some means of buoyancy has to be provided. This may be in the form of oil droplets or fat within the body; or spines, hairs, and flat projections from the body which present a broad surface to the water and thus slow down sinking. Of course, swimming animals can use their muscles to swim up from below. An advantage of living in water is that the density of water relieves the creature of the necessity of having to support its heavy weight (as on land) or to withstand the effect of gravity. Hence bones can be light, and aquatic animals can grow to a much bigger size—for example, whales.

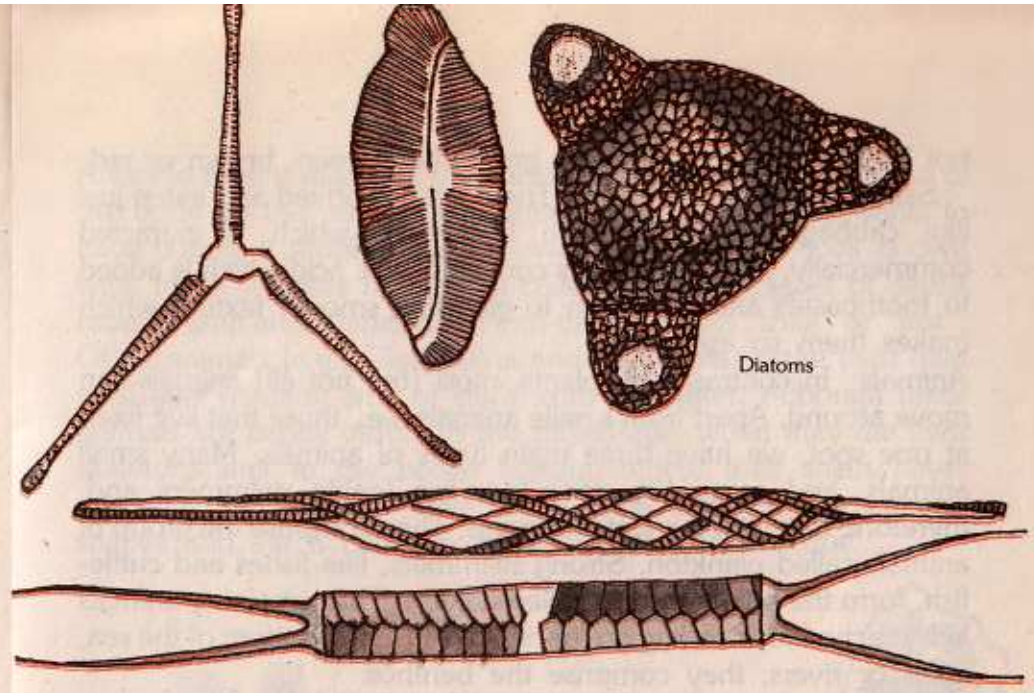
Animals living in streams and ponds, as well as those on the seashore, face the danger of the water drying up. Many animals cope with this by burrowing into the bottom mud and living in a state of suspended animation, where breathing and body activities become very slow.

Plants and animals living in turbulent waters have to avoid being swept away. This they do by developing suckers which help them cling to the water bed or to cracks between stones, and by having a flat body offering little resistance to water currents.

Compared to land creatures, reproduction is easy. Animals only have to shed their eggs and sperm in the water where these will unite and develop into young.

Many aquatic animals have developed a unique method of obtaining food. They let water containing food particles enter their mouth or body. The water passes over sieve-like devices where the food particles are retained and swallowed. Even the baleen whales, the biggest animals in the world, do this successfully.

You will notice that the contents of this book are divided into separate sections. Each section consists of animals (or plants) which are closely related to each other. The sections are arranged



in the order of the evolution of that group; those which appeared on earth earlier are described first. Thus, the text starts with one-celled animals and ends with mammals.

Plants Like trees and plants on land, aquatic plants require sunlight to manufacture food and build their tissues. Since water is not as transparent as air, light can penetrate down to only a hundred metres or so. Hence plants which grow attached to rocks or in the soil or mud are restricted to shallow waters. However, a large part of the plant population is made up of tiny one-celled organisms, called diatoms, which float in the water. They serve as food for equally tiny animals.

Many plants seen on the banks of streams and ponds are bog plants, which can live submerged below water for a short time, but are, in reality, land plants. Other plants live their whole lives submerged. In the sea their place is taken by seaweeds. These do

not bear flowers, and may be green, blue-green, brown or red.

Seaweeds have many uses. They can be cooked and eaten just like cabbage. They are rich in iodine, which is extracted commercially. Many seaweeds contain alginic acid which is added to toothpastes and ice-cream to give that smooth texture which makes them so appealing.

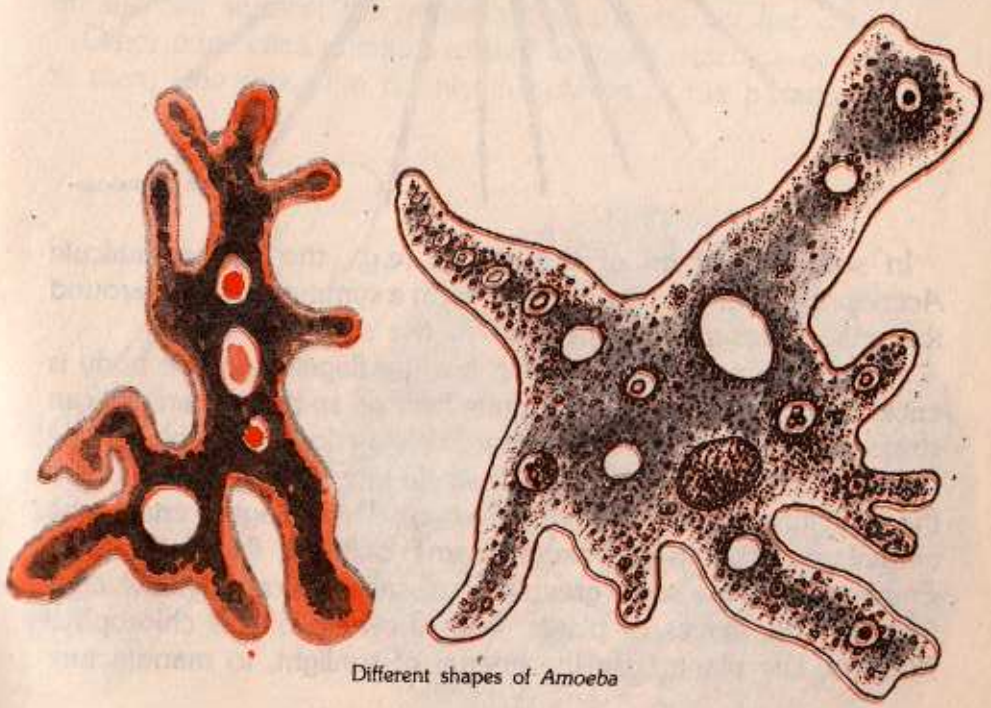
Animals In contrast with plants, most (but not all) animals can move around. Apart from sessile animals, i.e., those that live fixed at one spot, we have three main types of animals. Many small animals, and some big ones too, are feeble swimmers and, therefore, drift with the water currents. They comprise the group of animals called plankton. Strong swimmers, like fishes and cuttle-fish, form the second group called nekton. The remaining animals live attached to, crawling on, or burrowing in the bottom of the sea, lakes or rivers; they comprise the benthos.

One-Celled Animals

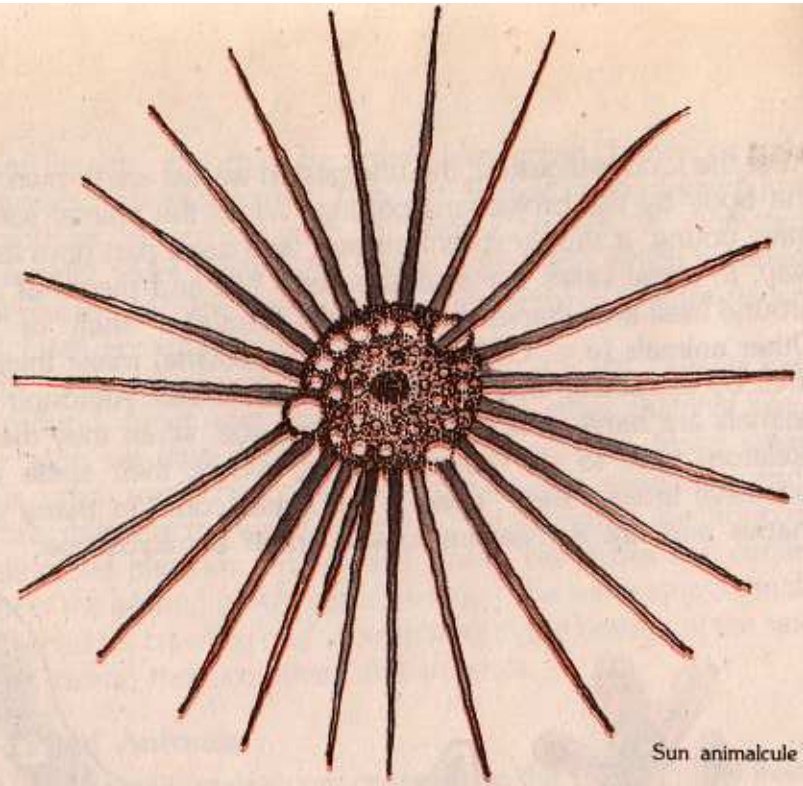
Our body is made up of many organs, like the stomach, the liver, the heart, the brain, kidneys and lungs. In turn, these organs are made of tissues like fat, muscle, cartilage, and the tissues are made up of tiny, microscopic units called cells. Thousands of cells live together in our body, and perform their own functions; we are, therefore, a multicellular organism. Animals, which first evolved on earth millions of years ago, were much more primitive, each consisting of only one cell.

One of the most primitive animals is *Amoeba*. The shape of its body is not constant, and the animal moves by extending a part of its body (called the pseudopodium, meaning false foot) forward, just as a drop of water moves on a smooth surface. If it comes across a food particle, these projections flow over it and engulf it.

After the food is digested, the undigested wastes are thrown out of the body by the projections parting. When the animal wants to have young, it simply splits into two, and each part goes its own way. In some cases the animal collects bits and pieces of debris around itself and shapes them into the form of a "shell" or "test". Other animals (e.g., Globigerina and Radiolaria) make their own shell by extracting lime or silica from sea-water. Although these animals are barely visible to the naked eye, when they die their skeletons sink to the ocean bottom, where their shells cover extensive areas called "ooze". The shells come in many pretty shapes and are a pleasure to see under a microscope.



Different shapes of *Amoeba*



Sun animalcule

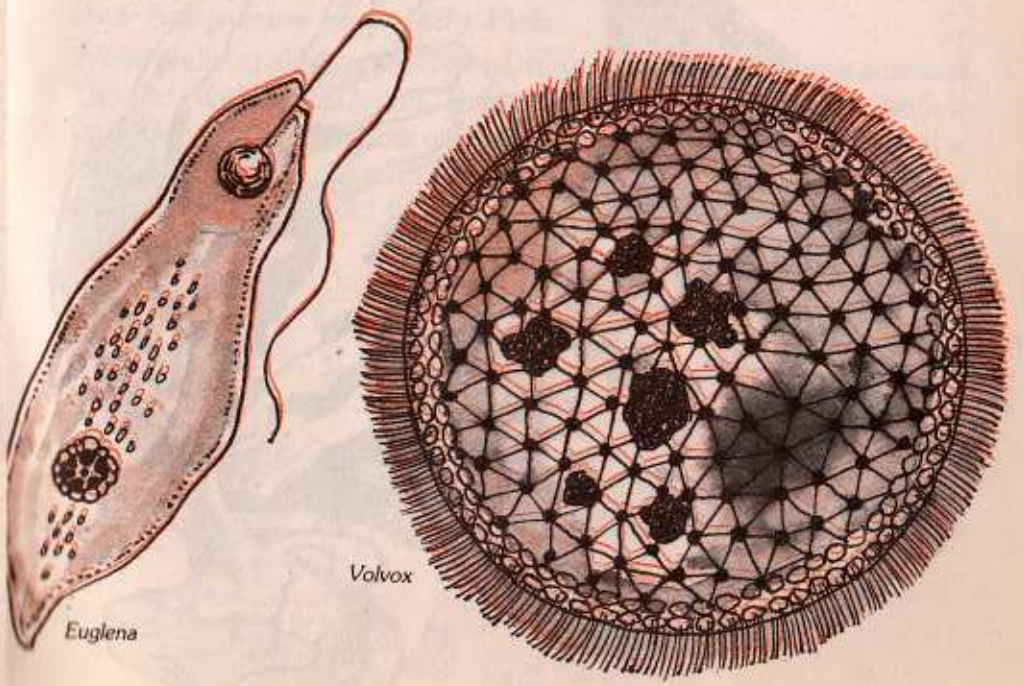
In some members of this group (e.g., the sun animalcule *Actinophrys sol)*, the pseudopodia form a symmetrical halo around the animal, resembling the rays of the sun.

A slightly more evolved group are the flagellates. The body is enclosed in a cell wall which is quite flexible, so that the animal can stretch or bend, but it cannot flow freely as does *Amoeba*. At one end of the body there is usually a single long whip-like hair, called the flagellum (sometimes there are two). These flagella enable the animal to move in the water. Some of these flagellates (e.g., *Euglena*) have the same green matter, called chlorophyll, which is found in the leaves of plants. With the help of this chlorophyll *Euglena*, like plants, use the energy of sunlight, to manufacture

their food. Botanists therefore claim that these green flagellates are plants but, because they can swim, zoologists say that they are animals! Some flagellates come close to one another to form a colony. Each animal *can* live separately but prefers to be in the company of its brethren. An example is *Volvox*.

Some of these flagellate animals can be a nuisance and may even be dangerous. One form, when it multiplies in large numbers, gives sea-water a red colour; hence it is known as "red tide". A fluid thrown out from its body is so poisonous that it kills fishes–the sea surface is sometimes covered by dead fish as far as the eye can see. Another form produces light and, when millions of them float on the sea surface, the water appears to be on fire.

Other one-celled animals, related to those which cause malaria in man, (the mosquito is only the carrier of the parasite which



Euglena

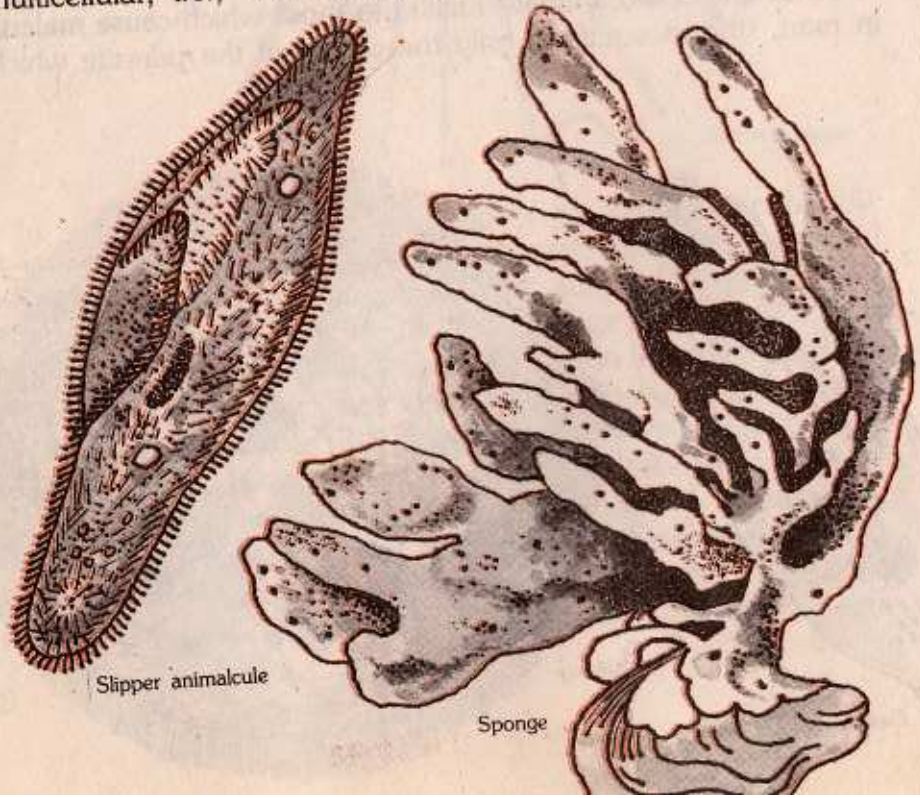
Volvox

causes malaria; the mosquito is not harmed by the parasite) cannot lead an independent existence but are parasites, attaching themselves to fishes and other animals, feeding on their body tissues or blood, and causing disease and death in the animals on or in which they live.

In the ciliates (e.g., slipper animalcule, *Paramecium*) the body is almost completely surrounded by short, hair-like "cilia". These beat in unison, looking like grass in a field bending with the wind, and help the animal to swim.

Sponges

While the most primitive animals are made of one cell, sponges are multicellular, i.e., their bodies are made of many cells. Most



Slipper animalcule

Sponge

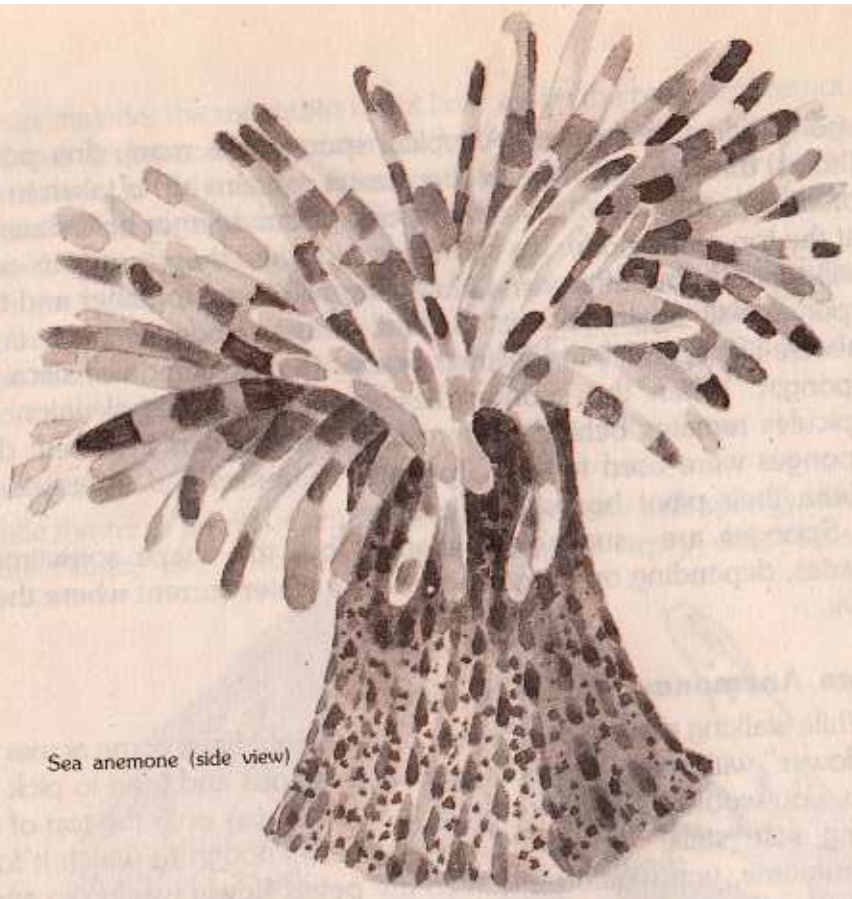
sponges live in the sea. A typical sponge has many tiny pores (holes) through which water (because it contains air) is taken in for breathing; the water leaves the sponge from a larger hole situated at the top of the body. If a sponge is squashed by pressing, its cells will separate but after some time, they will come together and the sponge will again take its original shape. Sponges have tiny, needle-like spicules inside their bodies that are made of silica or spongin. When the sponge dies and decays, this skeleton of spicules remains behind. Before foam rubber was invented, dry sponges were used to soak up water in homes and by artists to clean their paint boxes and brushes.

Sponges are usually vase-shaped, but the shape sometimes varies, depending on the strength of the water current where they live.

Sea Anemones and Jelly Fish

While walking along a sandy beach, you might have come across a "flower" with many petals. If you were curious and tried to pick it up, you would have noticed that the flower was only the top of a long, soft "stalk". And if you were patient enough to watch it for some time, you would have seen the petals slowly waving to and fro.

Sea anemone showing mouth surrounded by tentacles



Sea anemone (side view)

It so resembles a flower that even its name is "sea anemone", but it is actually one of many animals which exhibit a radial symmetry. If you draw a vertical line in the middle of a person's photograph you will find that the left side is a mirror image of the right. This is called bilateral symmetry. Some animals, however, can have many lines drawn through them which divide the body into symmetrical parts; this is radial symmetry.

The sea anemone has a hollow body with its mouth at the top in the centre of a whorl of many finger-like projections called tentacles. On these tentacles are many minute stinging cells, and when small fish or other animals brush against them, poison from the stinging cells is injected into them as if from so many syringes. The poison paralyses the prey; the tentacles then hold it and push it through the mouth into the hollow body which serves as a stomach. After some time, the undigested wastes are thrown out of the mouth. The sea anemone has no eyes and so it cannot see.

The sea anemone normally lives fixed by the base to one place, but it can move slowly. When it wants to multiply, it simply splits,

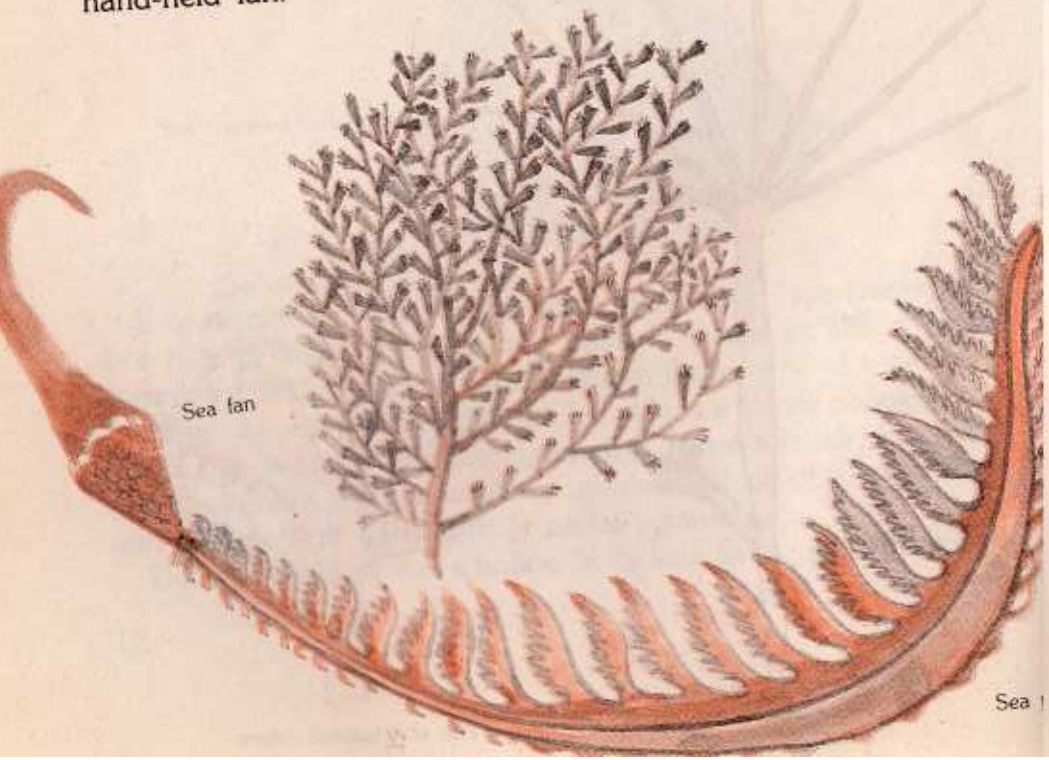
Hydra

Part of a hydroid colony

and each section grows to form two complete animals.

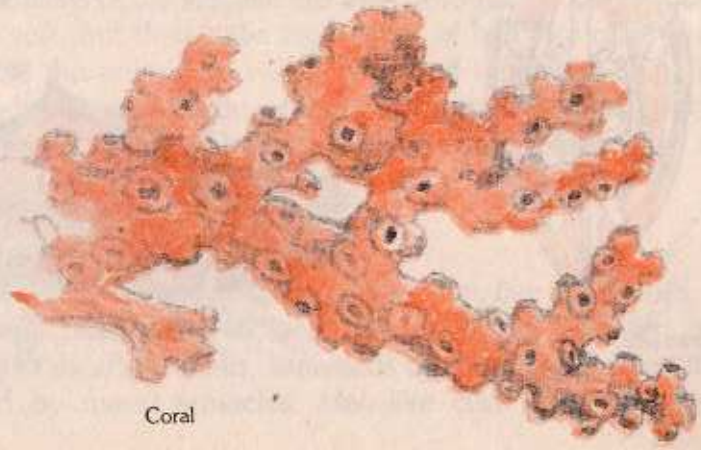
Imagine the sea anemone shrunk to a few millimetres, and you have its cousin, the freshwater *Hydra*. It is a single animal, but many others live together in colonies. The colony starts life as a single animal, but it throws out a branch on which grows another animal, and so on, till we have a branched, feathery colony. Even though the animals are so small, the stinging cells of some forms are so powerful that, when touched, we feel as much pain as if stung by a red ant.

In the sea pen, the animals are on either side of a long, central stem, which looks like a quill. In the sea fan, there are many branches arising from a base, used for anchoring to a stone. The branches fuse with each other into one plane to resemble a hand-held fan.



Sea

In corals, the animals extract lime from sea-water to build a skeleton pitted with cup-like holes. The animals normally withdraw into these cups, but extend out of these at night. In the tissues of many corals are tiny, one-celled plants. These use carbon dioxide and the wastes of the coral to manufacture their food. Reef-building corals, therefore, live in shallow seas where these plants can get sunlight. Corals come in many shapes, like the stag-horn coral, brush coral, pillar coral, finger coral, flower coral, tree coral, cluster coral, etc. In the brain coral, the skeleton is round and has furrows that look like those on our brain. The polypes of corals come in all the colours of the rainbow, and a coral reef is a really pretty sight. But, when the polypes die, only the white skeleton remains. Although corals are small, they build immense reefs. Many islands in the middle of the ocean, such as Lakshadweep in the Arabian Sea off Kerala, are made entirely of coral. Corals also abound in the Gulf of Kutch at Port Okha and Pirotan, and also fringe the Andaman and Nicobar Islands.

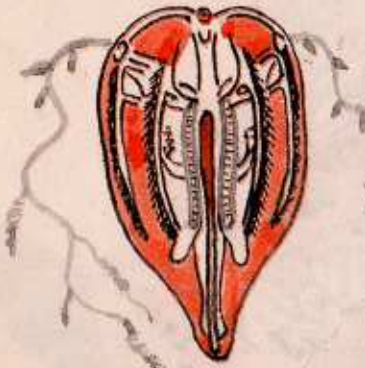


Coral

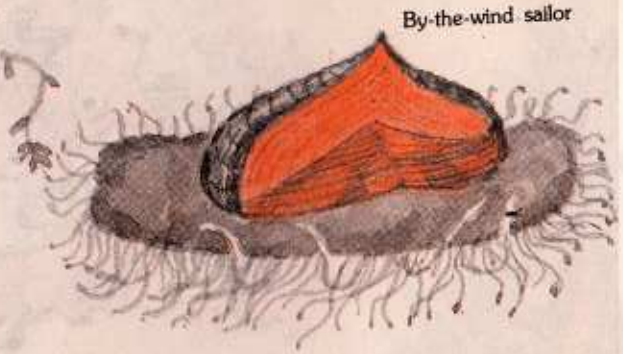
In other forms, the polypes do not look alike and perform different tasks. Thus, in the Portuguese man-of-war one polype acts as a float, others with their long tentacles catch food by poisoning with their stinging cells, and yet others serve for reproduction. The Portuguese man-of-war can kill even large animals, but one fish, *Nomeus*, is immune to its poison and shelters between the tentacles of the Portuguese man-of-war.

Porpita

Jellyfish



Comb-jelly



By-the-wind sailor

Porpita looks like a dark blue, flat disc about the size of a rupee coin and is a colony of polypes. In the by-the-wind sailor, there is a flat vertical "sail" on the top of the disc which helps the animal drift with the wind.

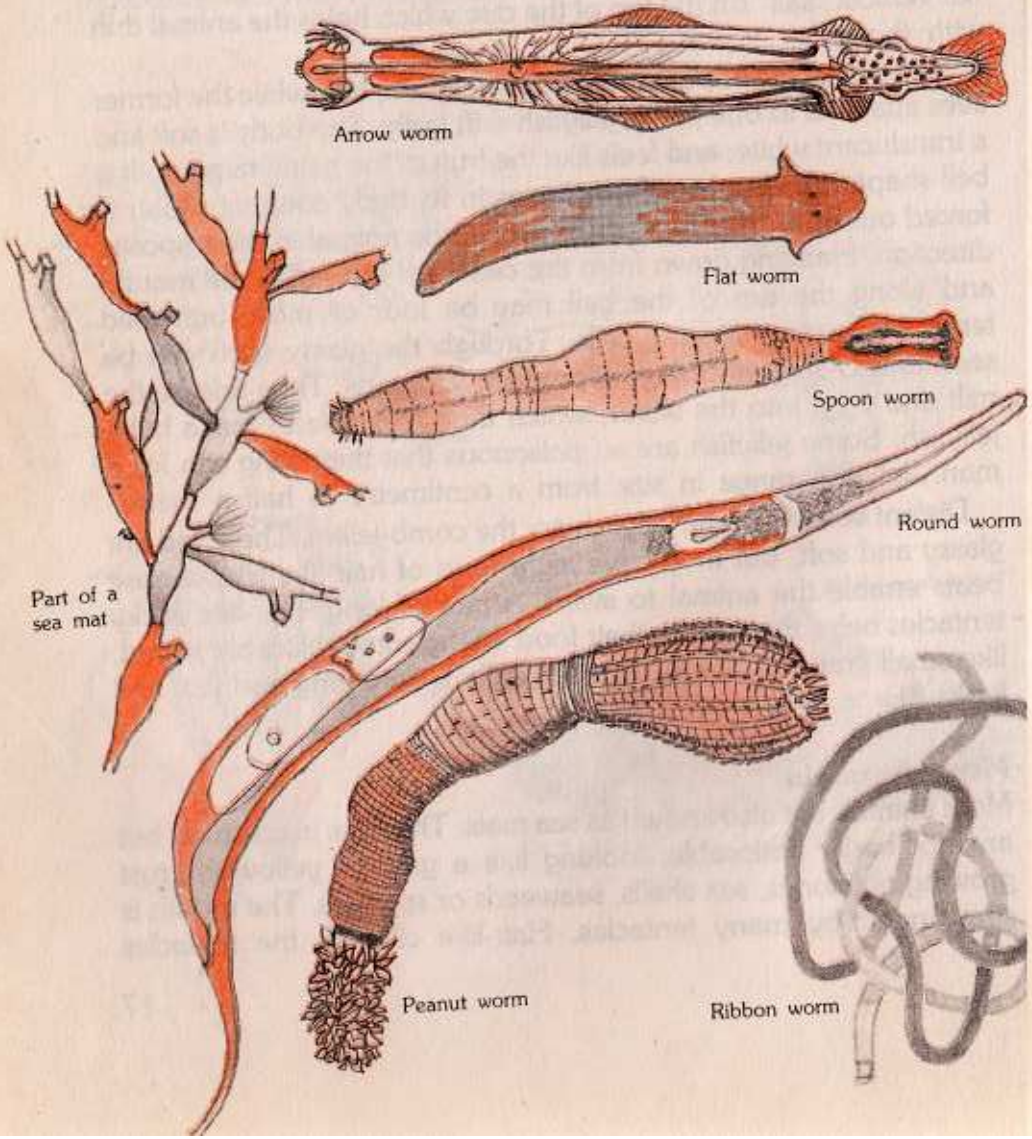
A cousin of the sea anemone is the jellyfish, but, while the former lives attached to one place, jellyfish drift lazily. The body is soft and a translucent white, and feels like the fruit of the palmyra palm. It is bell-shaped, and, when the muscles in its body contract, water is forced out from the rim so as to propel the animal in the opposite direction. Hanging down from the centre of the bell is the mouth, and along the rim of the bell may be four or more branched tentacles bearing stinging cells. Through the glassy flesh can be seen four U-shaped orange reproductive organs. They release the milt and eggs into the water, which then combine to make baby jellyfish. Some jellyfish are so poisonous that their sting can kill a man. Jellyfish range in size from a centimetre to half a metre.

Distant cousins of the jellyfish are the comb-jellies. These too are glassy and soft, but they have eight rows of hair-like cilia, whose beats enable the animal to swim. A pair of long, hair-like sticky tentacles helps them catch their food. Many comb-jellies are round, like small grapes, but the Venus's girdle is very long and flat, and looks like a belt.

Moss Animals

Moss animals are also known as sea mats. They live in colonies, but are not easily noticeable, looking like a grey or yellowish crust growing on stones, sea shells, seaweeds or sponges. The mouth is surrounded by many tentacles. Hair-like cilia on the tentacles

create a current and drive food particles into the mouth. At a casual glance they look rather like polype colonies, to which, however, they are not related. Some colonies grow as large as 100 cm.



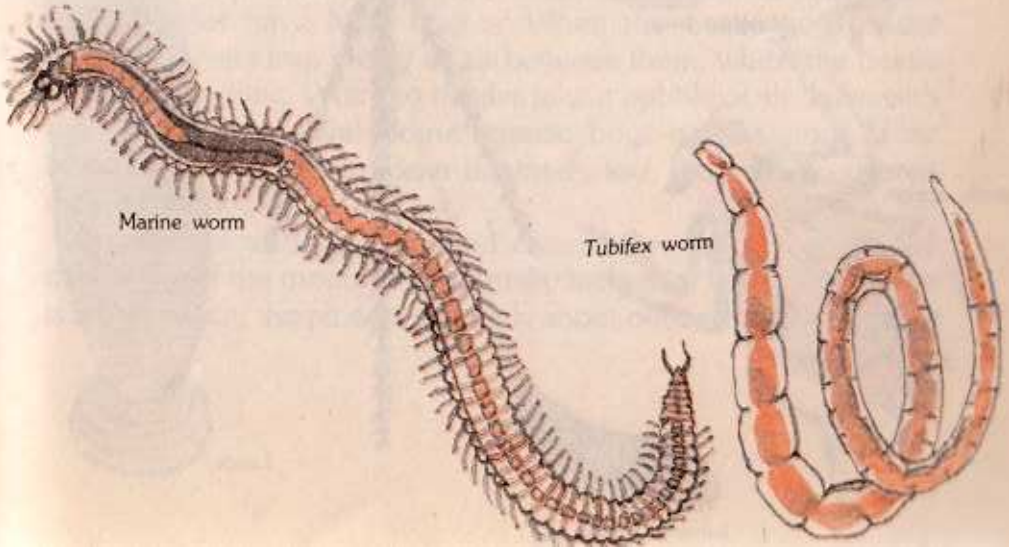
Worms

The word "worm" is used loosely to describe several animals which are only remotely related to each other. Thus, we have the flatworm (Platyhelminthes), round worm (Nematoda), ribbon worm (Nemertina), peanut worm (Sipuncula), spoon worm (Echiurida) and arrow worm (Chaetognatha). All these have a bilateral symmetry. Our illustrations will show you how they look.

In the more highly developed worms, the body is divided into many segments. An aquatic relative of the familiar earthworm, *Tubifex*, is found in large numbers near sewage outfalls. It buries its head in the soil and wriggles its body in wavy motion. It feeds on the organic matter found in sewage. Since the water in which it lives is poor in oxygen, its blood is red. (This is a rarity in animals without a backbone, whose blood is usually colourless or light blue.)

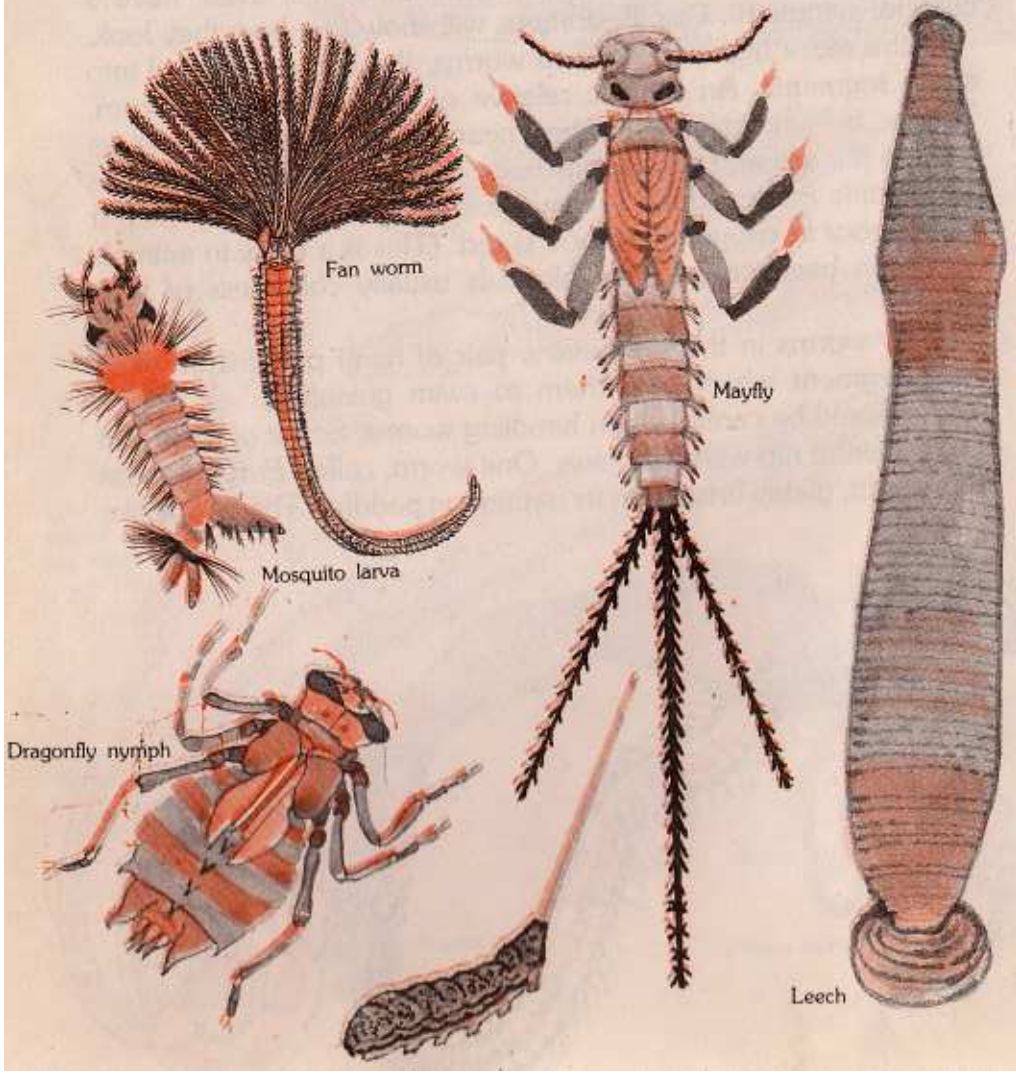
Many worms in the sea have a pair of hairy paddles on each body segment which help them to swim gracefully.

We should be careful when handling worms. Some of them can give a painful nip with their jaws. One worm, called *Eurythoe*, has tufts of stiff, glassy bristles on its swimming paddles. These look like



the nylon bristles of a toothbrush. When the worm is held, the bristles break and pierce the skin like glass splinters.

Fan worms and feather-duster worms do not swim, but live inside a tube made of mud or lime. On the head are many long,



thread-like tentacles, which capture minute food which sticks to them as they wave in the water. They also have primitive eyes which can detect light, so that, even if a shadow falls on them, the worms scuttle back into their tubes.

A leech, too, is a segmented worm. Some leeches are aquatic and feed on the blood or body fluids of fishes, turtles, snails, crabs and even insects.

Insects

Many insects live their entire lives under water. Others, though living on land as adults, have their babies (known as larvae) growing under water. Examples of the latter are stone flies, alder flies and mayflies. In all these, the larvae are long-lived (from two to three years), but the adults have a short life—only a few hours in the case of mayflies.

Insects and their larvae have developed clever methods of getting their air supply while under water. In some aquatic bugs, the larva lies at the pond bottom, but sends a very long, flexible tube up to the surface. The larvae of some butterflies and moths make a "tent" by stitching two leaves together. They then crawl down into the water, carrying the case which holds air with them. Riffle beetles have hairy bodies. When the beetle goes under water, the hairs trap plenty of air between them, which the beetle uses for breathing. Whirligig beetles take a bubble of air down with them when they dive. Some aquatic bugs have a store of air between their wings. In water boatmen, too, the body is covered with air bubbles.

The larvae of dragonflies and damsel flies have a pincer-like device under the mouth. It is normally tucked in, but when its prey is within reach, the pincers suddenly shoot out and catch the prey;

they then spring back to deliver the food into the mouth.

Mosquitoes, crane flies and midges fly in the air, but lay their eggs on water, and the larvae are aquatic; they are known as wrigglers. They lie motionless just beneath the water surface, breathing air through a short tube. But, at the slightest disturbance, they wriggle down and stay below for some time.

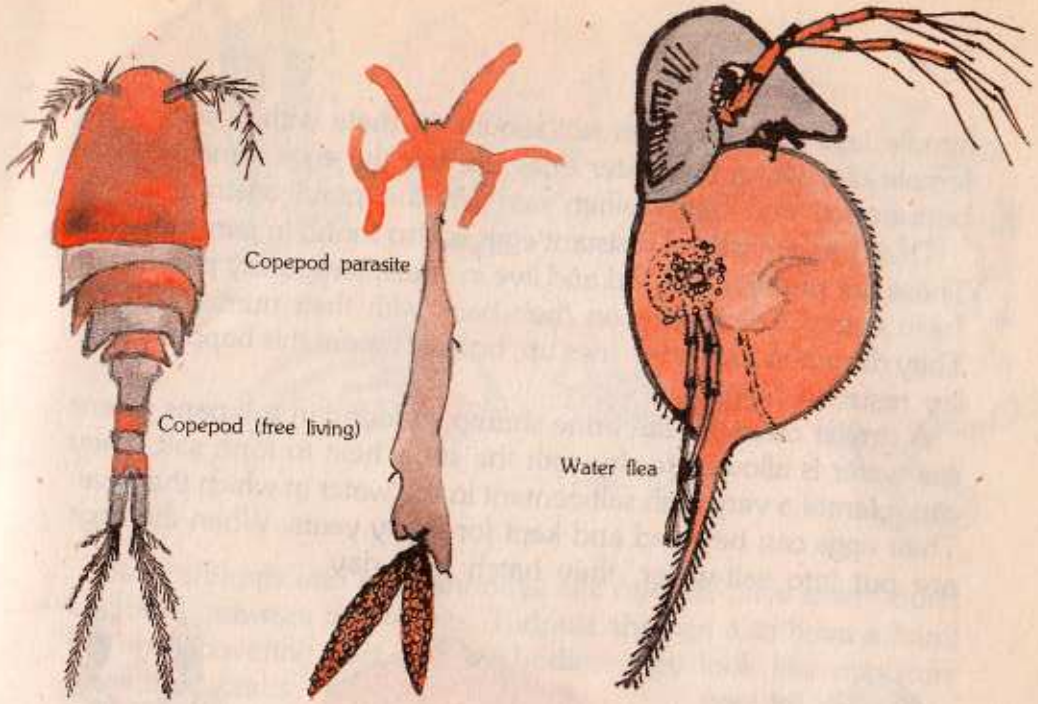
Only one kind of insect, *Halobates*, is found in the seas. It can be seen many kilometres away from land, walking on the sea surface.

Animals with jointed Limbs

Just as insects dominate the land, having the largest population and variety, their relatives the Crustacea dominate the waters. Like worms, their bodies are segmented but the number of joints is far fewer. Their legs are jointed and their bodies are encased in a hard armour made of chitin—a substance similar to the horn of cattle or our finger-nails. They do not grow steadily, for the tough outer casing restricts expansion. They remain of the same size for many weeks or months. One fine day, their skin splits, and a soft animal comes out. It drinks a lot of water and absorbs the lime from the water and starts building a new outer shell. When the new skin is soft, the body suddenly increases in size, but, in a few days the shell will have hardened, and no further growth will take place until the next time the skin splits. This process of throwing off the body-shell is known as moulting.

Many crustaceans can break off their limbs at will. The break occurs at a particular place, where a blood vessel gets squeezed to prevent bleeding. If an enemy catches a crustacean by a leg, this will break and remain behind with the enemy while the crustacean escapes. A new limb will grow in its place.

Among the most numerous animals in the sea are the copepods.



Small in size, only a few millimetres long, they are the grazers of the sea, like sheep or goats on land. They feed on the small plant life drifting in the water and, in turn, serve as food for larger animals and fish. They make up in rapidity of breeding for what they lack in size, so that, even though thousands are eaten every day, their number does not decrease.

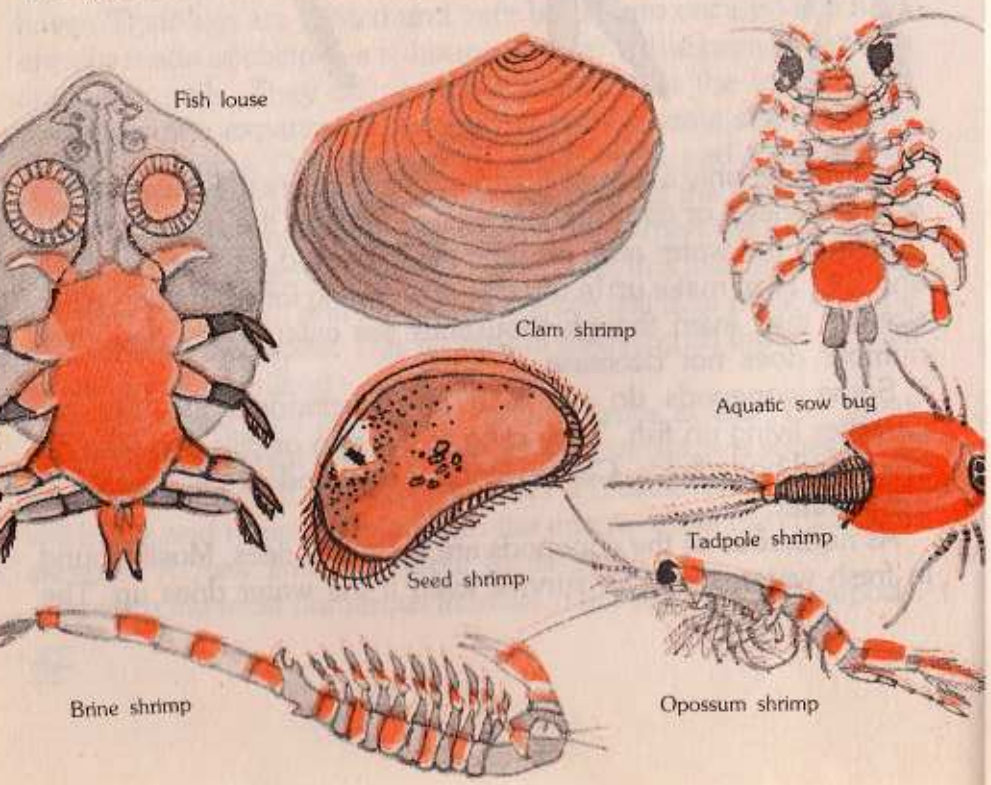
Some copepods do not lead an independent life, but are parasites living on fish. They cling to the skin or gills and feed on blood and body fluids. Certain kinds of copepods are also found in fresh water.

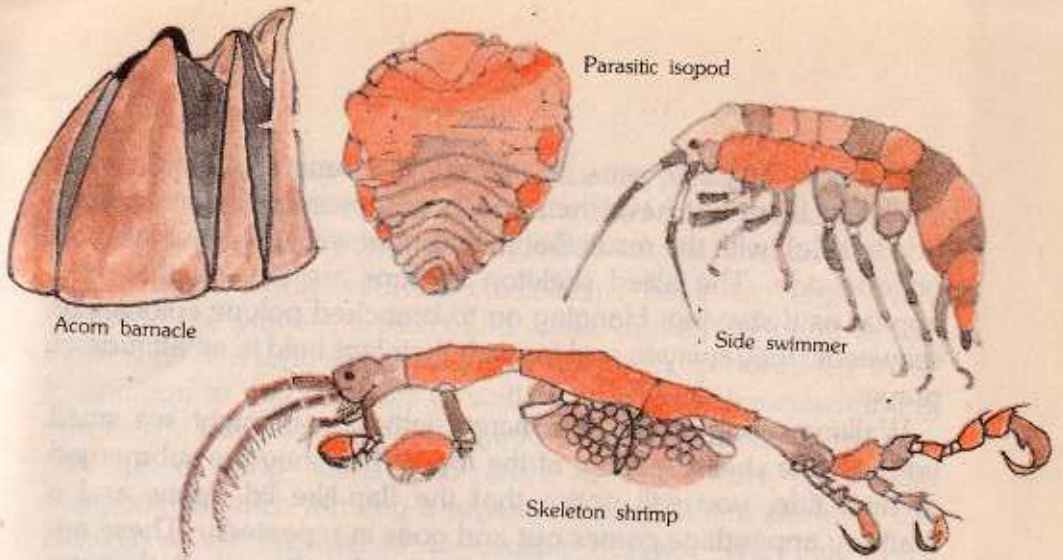
As numerous as the copepods are the water fleas. Mostly found in fresh water, they can survive even if the water dries up. The

female lays eggs but does not require to mate with a male. The female dies when the water dries up, but the eggs remain in the bottom soil and hatch when rain fills the pond again.

This characteristic of resistant eggs is also found in fairy shrimps. These are prettily coloured and live in small, temporary puddles of fresh water. They swim on their back with their numerous legs. They die when the water dries up, but just before this happens they lay resistant eggs.

A similar creature, the brine shrimp, is found in salt pans where sea-water is allowed to dry with the sun's heat to form salt. They can tolerate a very high salt content in the water in which they live. Their eggs can be dried and kept for many years. When the eggs are put into salt-water, they hatch in a day.





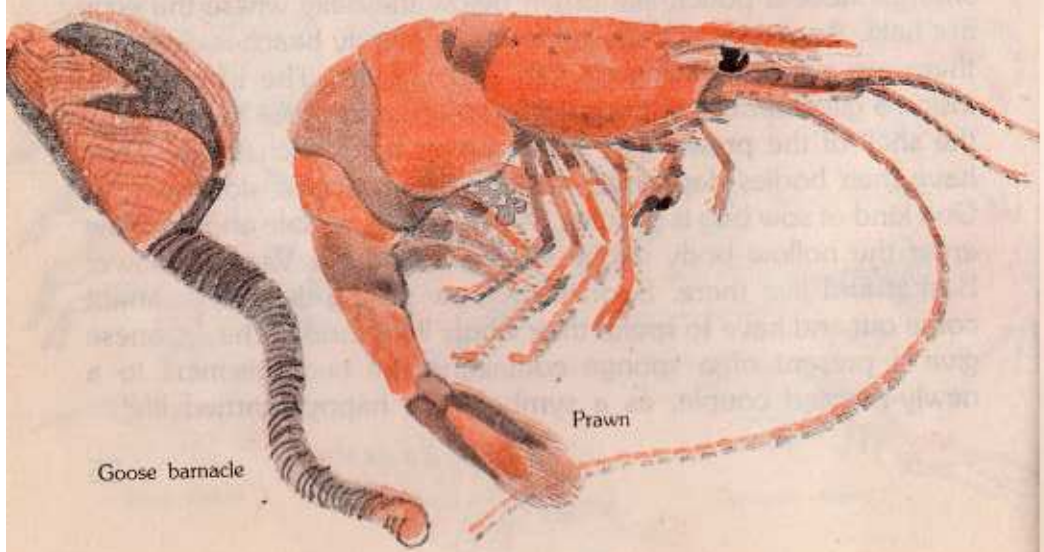
Seed shrimps and clam shrimps, like oysters, have their bodies enclosed between two valves. Tadpole shrimps also have a hard, flat shell covering part of their bodies; they look like miniature horseshoe crabs.

Fish lice have flattened, horseshoe-shaped bodies. They grow up to a centimetre and are parasites living on fish. Opossum shrimps have a pouch-like organ below the belly where the eggs are held. Aquatic sow bugs are found on sandy beaches. A few of them are parasites living on fish and prawns. The isopod lives inside a gill-chamber of the prawn. To accommodate the parasite, the shell of the prawn gets swollen over that gill-chamber. They have their bodies depressed (flattened from above, downwards). One kind of sow bug is peculiar. When young, a male and a female enter the hollow body of the sponge called the Venus's Flower Basket and live there. Soon they grow so big that they cannot come out and have to spend their whole lives inside. The Japanese give a present of a sponge containing the two prisoners to a newly-married couple, as a symbol of a happy married life!

The sow bug's cousins, called side swimmers or scuds, look similar to them but have their bodies compressed (flattened from side to side), with the result that they cannot walk erect but fall over on one side. The allied skeleton shrimps are so slim that they appear as if starving. Hanging on to branched polype colonies or seaweeds, they sway to and fro with their legs held in an attitude of prayer.

Walking along stone or concrete jetties, you might see small volcano-like shells opening at the top. When they are submerged at high tide, you will notice that the flap-like lid opens and a feathery appendage comes out and goes in repeatedly. These are acorn barnacles, and though they live inside a limy shell, they are not snails but crustaceans. While the majority are only a few millimetres across, a few grow to over 5 cm. Some acorn barnacles grow on the shells of turtles and even on whales.

Their cousins are the goose barnacles—so called because people once believed that geese were born from them. They have a leathery stalk enlarging into a flattened body covered by a few



flat, limy plates. They usually live on floating pieces of wood, but I have also seen them on glass bottles and even on rubber slippers floating in the sea. Some live attached to sea snakes.

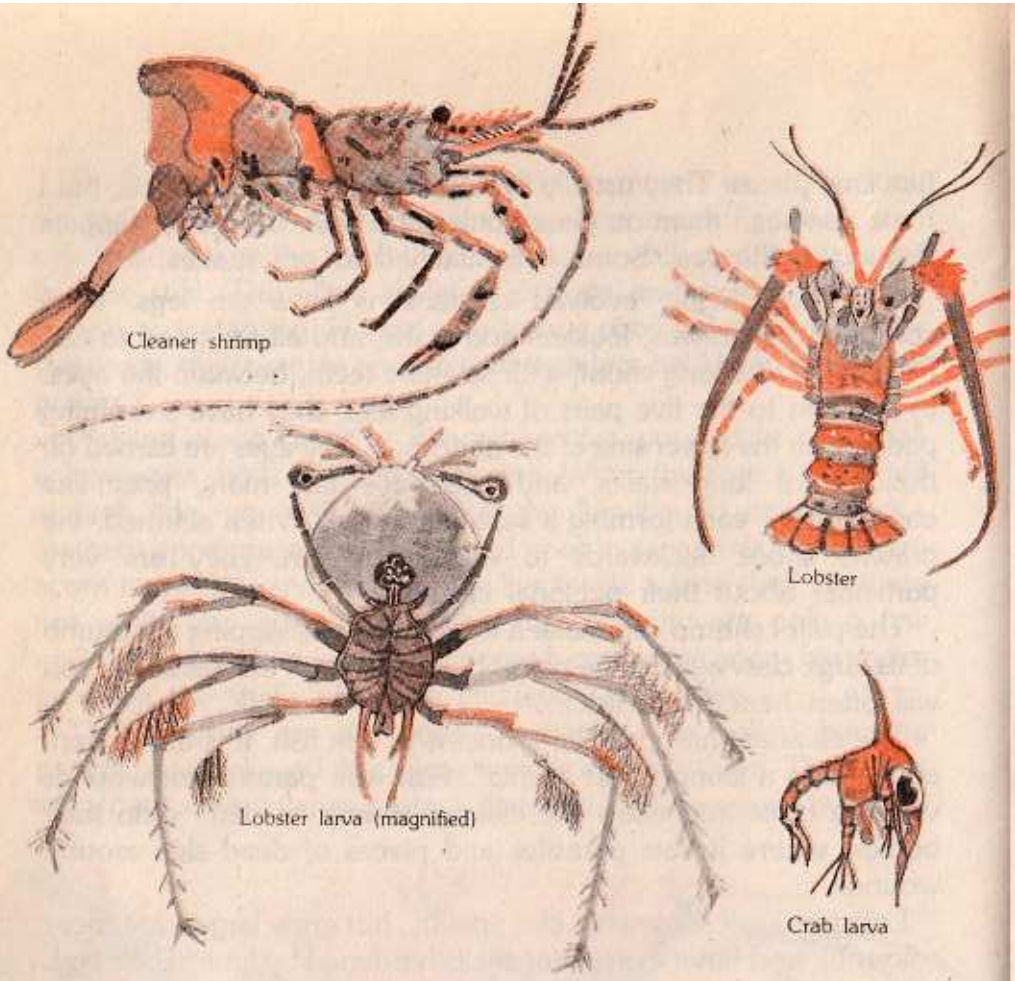
The more highly evolved crustaceans have ten legs. They comprise the prawns, lobsters and crabs, and all are good to eat. Prawns have a long snout, with saw-like teeth, between the eyes. In addition to the five pairs of walking legs, they have swimming paddles on the lower side of the abdomen. The eyes are carried on the tips of long stalks, and each eye has many prism-like components, each forming a separate image. When alarmed, the prawns shoot backwards to escape danger. They are very particular about their personal cleanliness.

The pistol shrimp can make a loud noise by snapping the thumb of its large claw against the palm. If you stand on the seashore, you will often hear their clicks.

The cleaner shrimp is like a doctor to sick fish. It is transparent and selects a stone for its "clinic". Fish with parasites or wounds visit the clinic and allow the cleaner shrimp to climb onto their bodies, where it eats parasites and pieces of dead skin around wounds.

Lobsters look somewhat like prawns, but grow larger, are more colourful, and have their outer shells hardened by lime. Their eggs remain attached to the swimming paddles for a few weeks while the babies form inside the eggs. Baby lobsters look very different from the adult, having a flat, leaf-like, transparent body with long legs. Lobsters walk on the sea bottom but can swim backward for short distances by flapping their abdomens.

Crabs have very small abdomens which are tucked under the body. Their sex can be easily made out by turning the crab over. The male has a narrow, V-shaped abdomen, but in the female it is



much wider. Crabs too carry their eggs tucked under their bodies, but their babies are very different from those of lobsters, having long spines on their heads and noses. In walking crabs, all the legs end in pointed tips, but in swimming crabs, the tips of the last pair are flattened to act as swimming paddles. In all crabs, the first pair of legs is modified to form claws, and in many crabs these claws are much larger in the male.

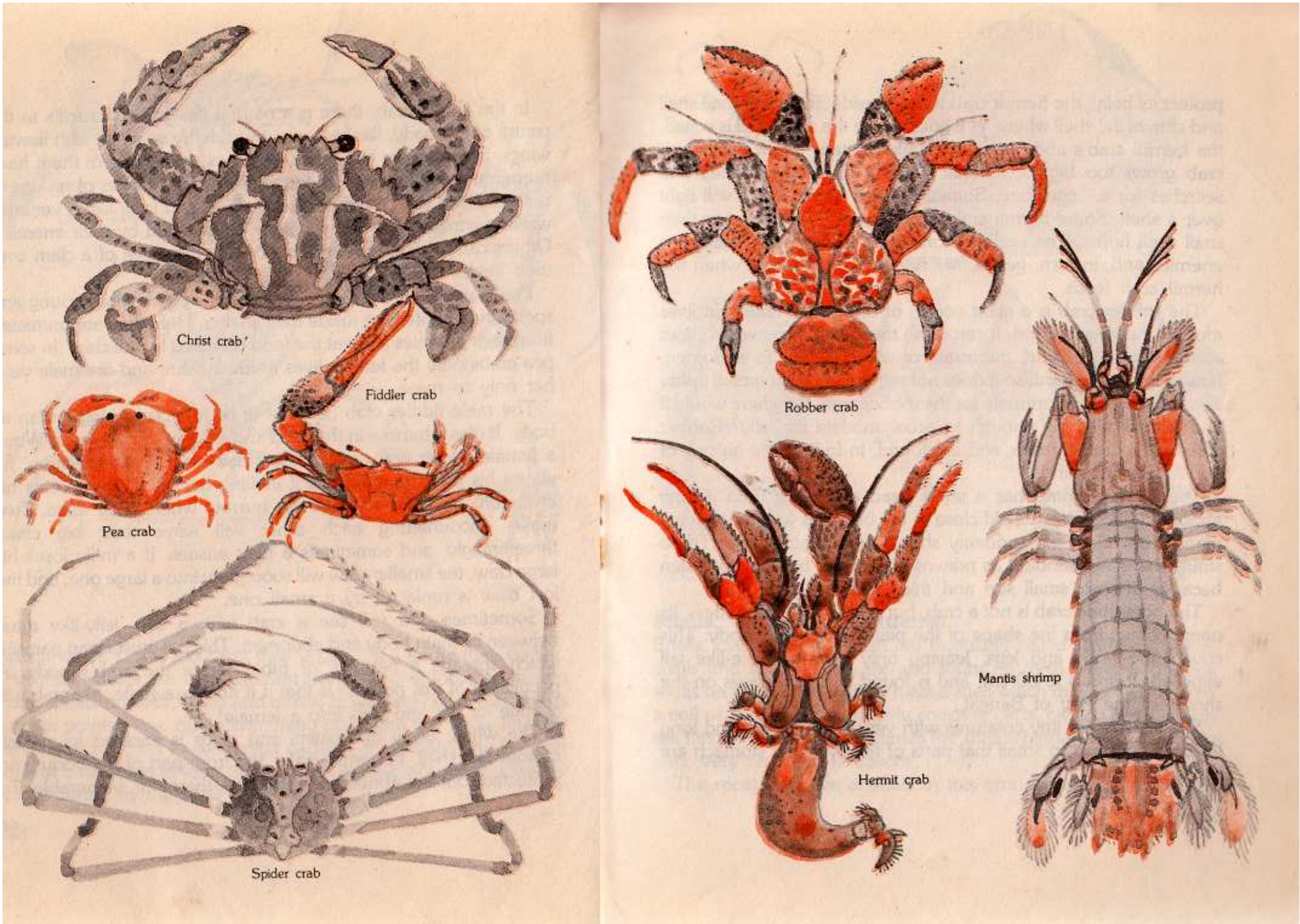
In the Christ crab, there is a natural design of a crucifix in the centre of the body, flanked on either side by an angel with flowing wings. Spider crabs have very long legs, and many of them have numerous spines. Some spider crabs break off pieces of sponge or seaweed and stick them on their spines, and look like a veritable walking garden. Thus they cannot be detected by their enemies. Others carry a large piece of sponge or the valve of a clam over their backs.

Pea crabs enter the shells of clams or oysters when young and spend their entire lives inside their shelter. Here they are protected from their enemies and eat the food collected by the clam. In some pea crabs only the female lives inside a clam, and the male visits her only to mate.

The male fiddler crab has one of its two claws bigger than its body. It digs a burrow in the sand and waits at the entrance. When a female fiddler crab (which has small claws) passes nearby, he waves his claw frantically as if inviting her in. If she accepts his invitation, he leads her into his burrow where they mate. Two males encountering each other will wave their big claws threateningly, and sometimes a fight ensues. If a male loses his large claw, the smaller claw will soon grow into a large one, and the lost claw is replaced by a small one.

Sometimes you will see a crab with a soft, jelly-like mass between its main body and abdomen. This is a crustacean parasite which spreads a network of tubes inside the crab's body. A peculiarity of this parasite is that if it attacks a male, the crab will change its sex and turn into a female!

The whole body of lobsters and crabs is encased in a thick armour-like shell. In hermit crabs, the front part of the body is so protected, but the abdomen is soft and, therefore, vulnerable. To


Christ crab
Fiddler crab
Pea crab
Spider crab
Robber crab
Hermit crab
Mantis shrimp

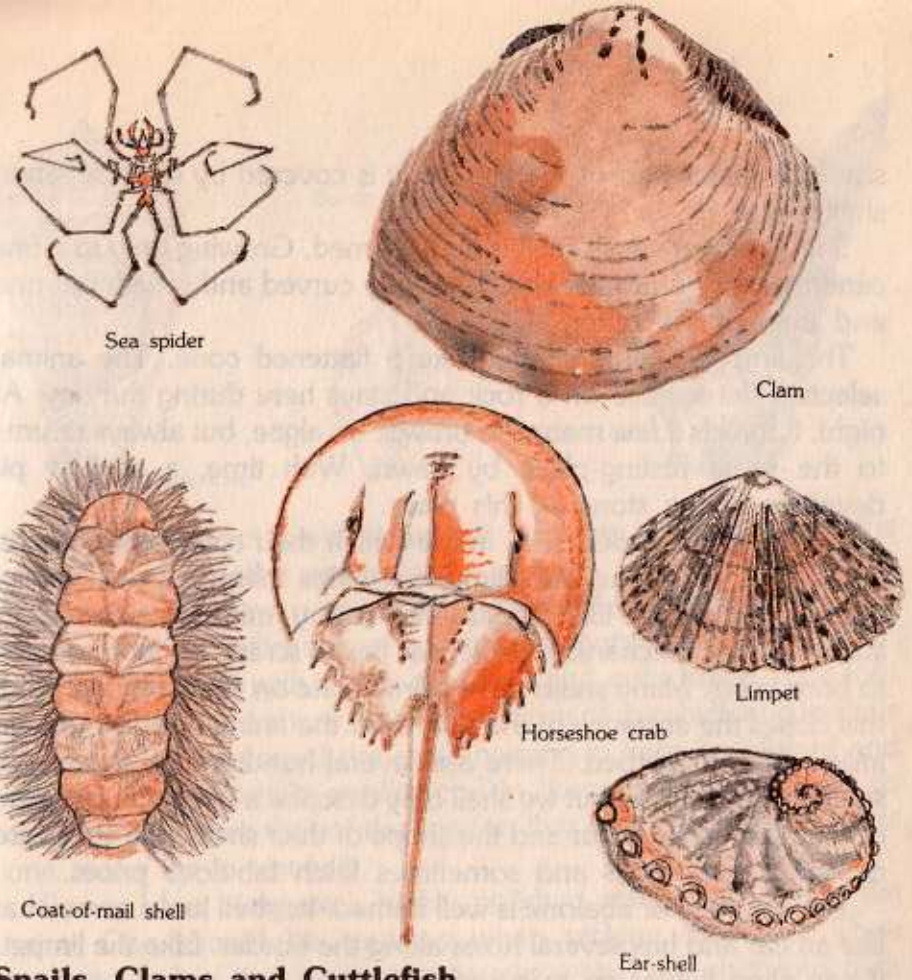
protect its belly, the hermit crab tucks it inside an empty snail shell and carries the shell wherever it goes. Since the snail shell is coiled, the hermit crab's abdomen is similarly twisted. When the hermit crab grows too big for its snail shell, it discards the shell and searches for a bigger one. Sometimes two hermit crabs will fight over a shell. Some hermit crabs place a sea anemone over their snail shell home. The sea anemone gives it protection against its enemies and, in turn, gets a free ride and bits of food when the hermit crab feeds.

The robber crab is a giant cousin of the hermit crab, but lives most of the time on land. It can climb trees, and its powerful claws easily break a coconut, the inside of which it eats. Its abdomen, however, is quite hard, so it does not require to be protected inside a snail shell. This is fortunate for the robber crab, for where would it find a snail shell big enough to accommodate its belly? Robber crabs are extremely rare, and are found, in India, only on one of the Andaman Islands.

The mantis shrimp has a short head and chest, and a long abdomen. Its claws are held close to the body, as with the praying mantis, but they can suddenly shoot out to catch prey. These shrimps are as abundant as prawns in the sea, but are not eaten because of their small size and thick shell.

The horseshoe crab is not a crab, but is related to the spiders. Its name comes from the shape of the plate covering its body. This covers the body and legs, leaving only a long, spike-like tail exposed. It grows to 60 cm, and is found at a few places on the shores of the Bay of Bengal.

Sea spiders are tiny creatures with very small bodies and long legs. The body is so small that parts of the liver and stomach are inside the legs.



Snails, Clams and Cuttlefish

Snails, clams and cuttlefish are popularly called sea shells; many snails and some clams are also found in fresh water and some snails on land. They usually have a shell which may be twisted into a coil or consist of two slightly concave parts, called valves, which are hinged together. Sometimes the shell is hidden inside the body and, very rarely, it is absent.

The most primitive animals in this group are the coat-of-mail

shells. A major part of the soft body is covered by eight separate shell plates.

The elephant's tusk shell is aptly named. Growing only to a few centimetres, the tubular shell is slightly curved and is wider at one end than at the other.

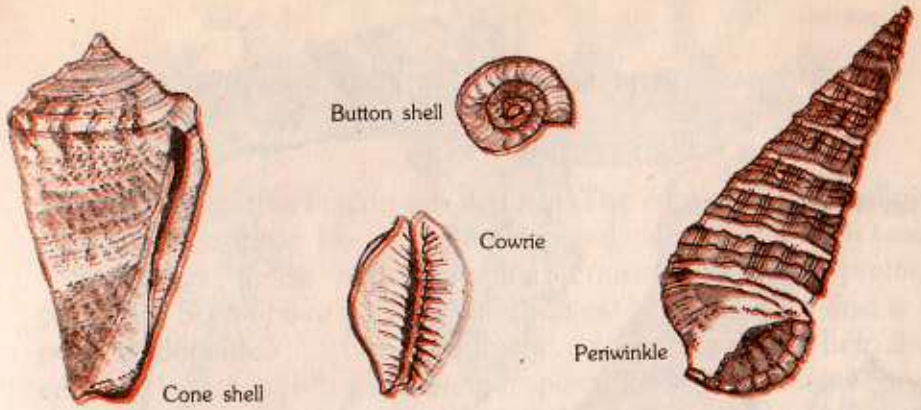
The limpet shell is shaped like a flattened cone. The animal selects a flat surface on a rock and stays here during the day. At night, it travels a few metres to browse on algae, but always returns to the same resting-place by dawn. With time, a shallow pit develops in the stone at this place.

Snails have a coiled shell inside which their soft bodies can be withdrawn. A tongue-like, slimy foot helps them to crawl slowly. The snail's ribbon-like tongue has many minute teeth on its surface, like a mechanic's file; it uses this to scrape off food or even to bore holes. Many snails have a limy plate on the foot. Like a lid, this closes the entrance of the shell after the animal has withdrawn inside when disturbed. There are several hundreds of varieties of snails in our country but we shall only describe a few here. Because of their beautiful colour and the shape of their shells, sea shells are collectors' favourites and sometimes fetch fabulous prices.

The ear-shell or abalone is well named. Its shell looks somewhat like an ear and has several holes along the border. Like the limpet, it can cling tightly on to a rock.

The minute button shell is very pretty, and comes in several colours, varying from pink, brown, and greyish blue to white. The size of a shirt button, its shell is found in large numbers on sandy beaches.

Periwinkles can endure being dry for quite some time. They have slender conical shells and are found on rocks or stone walls at a greater height than where acorn barnacles abound—where

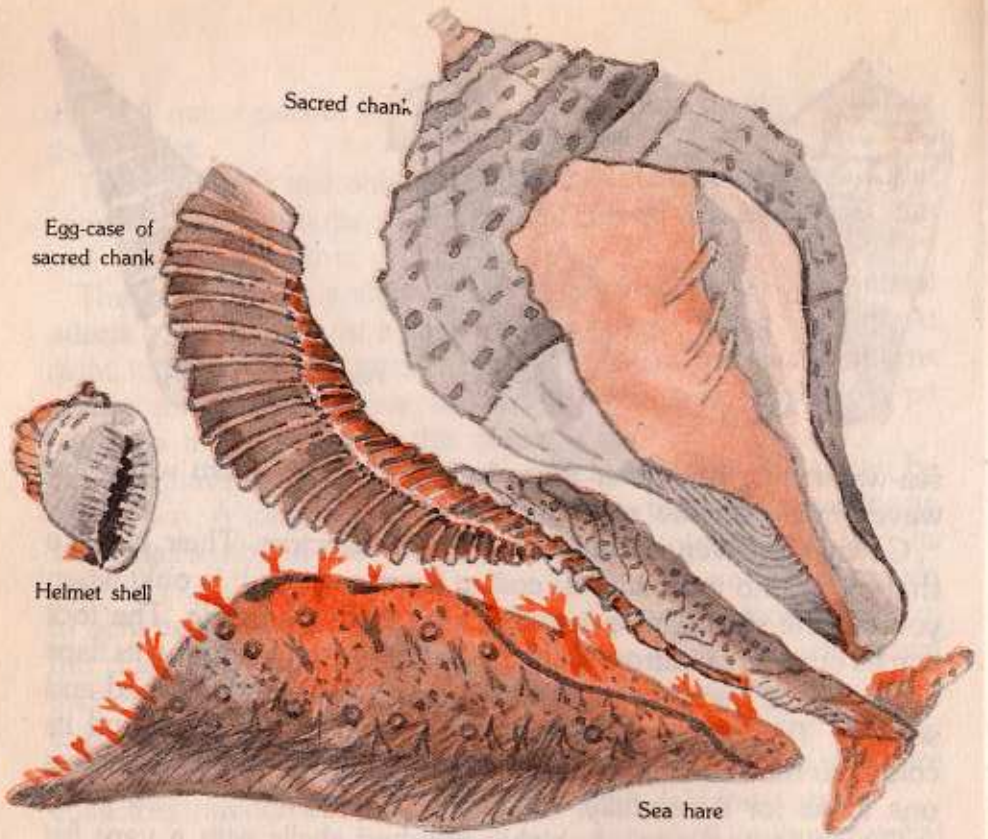


sea-water may not cover them but splashes on them when the waves break on the seashore.

Cowries are very popular with shell collectors. Their egg-like shape gives no indication of coiling from outside. It is only when you cut the shell with a saw that you find coils inside. The foot comes out from a narrow slit at the bottom of the shell, and its flaps cover a large portion of the shell, helping to keep it polished and smooth. The cowrie's smaller cousin lives on sea fans, and its colour so matches that of the sea fan that it can be missed unless one looks for it carefully.

Cones have elongated, highly polished shells with a very flat spire. One should be cautious when picking them up. Their tongues end in tiny poisonous arrows which are shot into their prey. In some cones the poison is so powerful that it can kill a human being.

The sacred chank is plain white. It is made into trumpets which temple priests blow. The shell is made into bangles. Its egg-case looks like a ram's horn made of about 25 capsules with slits which allow water to flow in. The young eat each other, and only a few hundred come out alive from the egg-case.



The helmet shell is very heavy and large shells weigh upto a kilogram. Its shell, as well as those of cowries and wing shells are used to carve or etch designs or as a cameo.

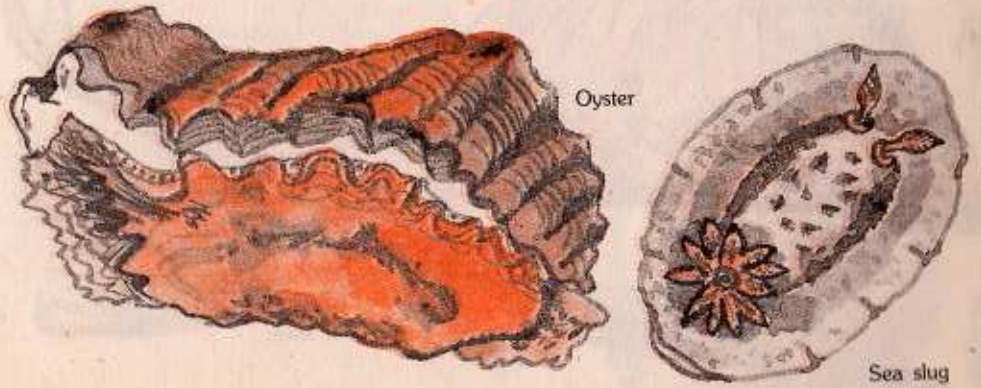
The sea hare can be found on rocky shores among seaweeds. It has a soft, bottle-green body and a head with two pairs of tentacles, the longer ones looking like a rabbit's ears. There is a soft, transparent, glassy shell inside the body, but it cannot be seen without cutting open the animal. When disturbed, the sea hare

throws out a purple fluid in self-defence. The eggs are laid in yellow strings and appear like a ball of tangled twine.

Sea slugs, unlike their ugly land cousins, are very prettily coloured. Some have flat, disc-like bodies. Near the hind end is a pore inside which is a bunch of feathery gills, with whose help the sea slug breathes. It is fascinating to place a sea slug in water and see this "flower" appear from within the body and bloom. Other sea slugs have a long, tapering body with many exquisitely coloured hair -or finger-like organs on the back.

Sea slugs feed on sponges, sea fans, corals and polypes. They are not harmed by the stinging cells of their prey; on the contrary, they swallow the stinging cells. These lodge inside their bodies and, when an animal tries to eat the sea slug, the stinging cells come into action and protect the sea slug.

In the second major group of sea shells, the shell consists of two valves and is not spirally coiled. Water is taken in from a tube called the siphon and passes over the gills. Small food particles are trapped here and eaten, while the water goes out by another

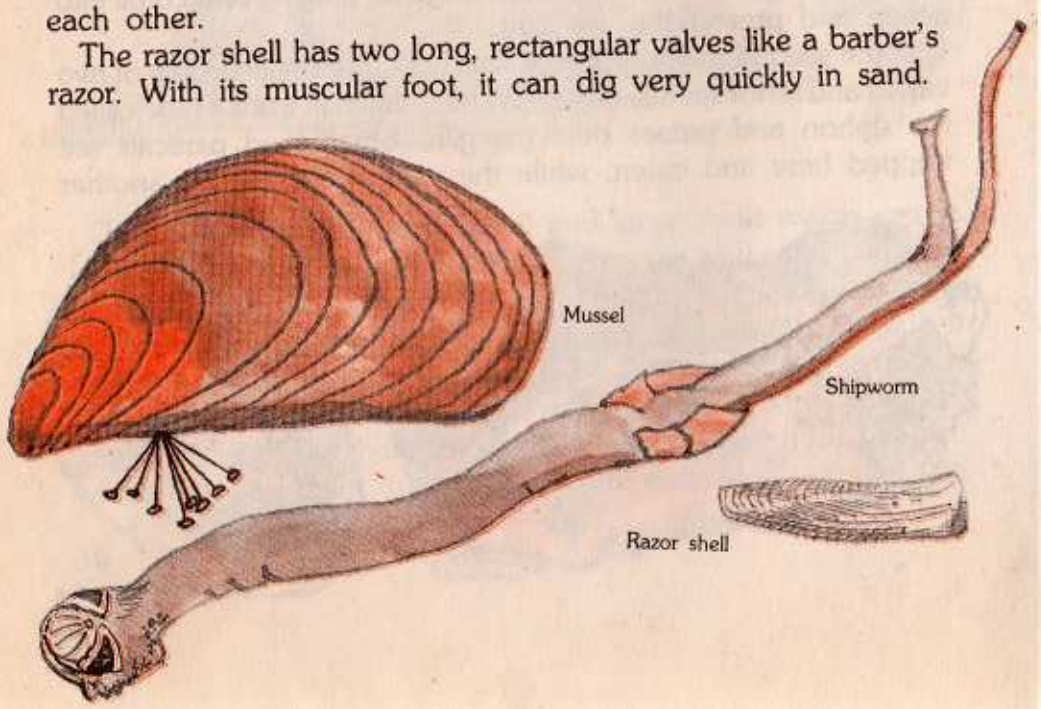


siphon. Many of the bivalves are commercially important as they are found in large numbers and eaten. One should be careful, however, not to eat those living in polluted waters, as their bodies may hold the germs of typhoid and other gastro-intestinal disorders.

Oysters live permanently stuck to rocks. The larger valve is attached by a kind of cement produced by the animal, and the smaller valve is on top of this. Windowpane oysters live buried in the mud. Their shells are thin, quite flat and in the shape of a disc some 15 cm across. They are translucent and were earlier used, instead of glass, for glazing windows. Like oysters, small pea crabs live inside their shells.

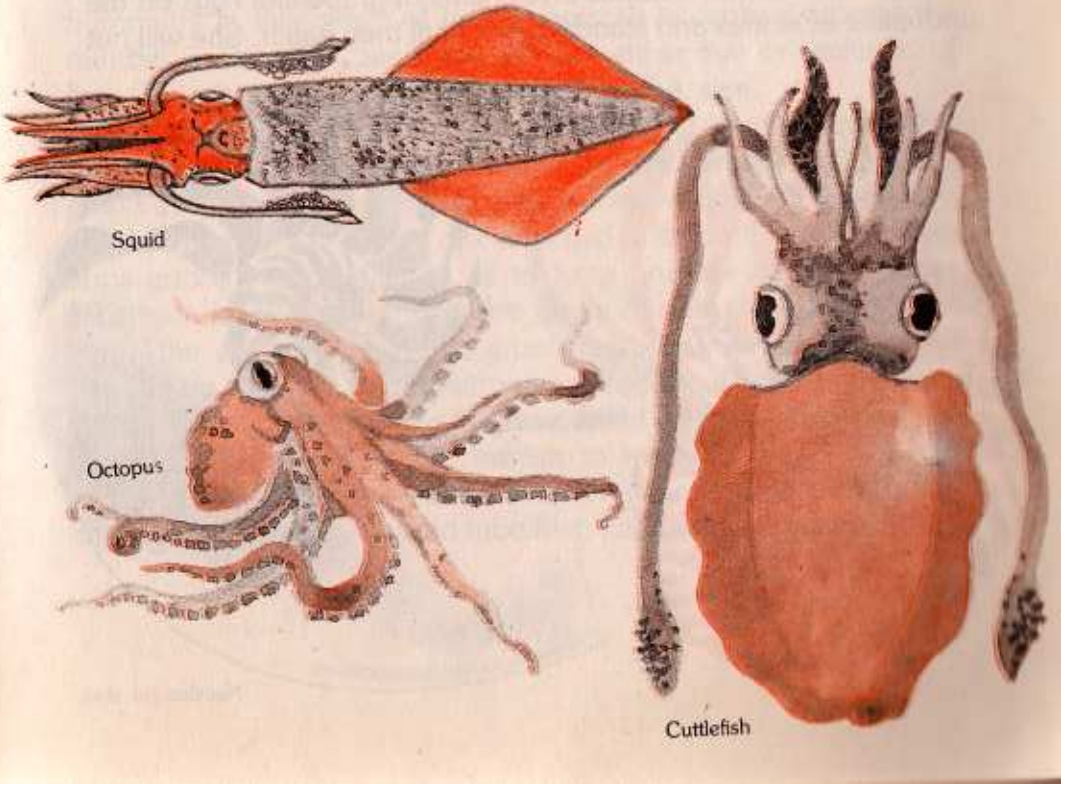
Mussels have long, brown or bottle-green shells. They too live attached to stones, but are not permanently cemented. They produce a sticky string which anchors them, but they can break this off and move to another place. Mussels grow in clusters close to each other.

The razor shell has two long, rectangular valves like a barber's razor. With its muscular foot, it can dig very quickly in sand.



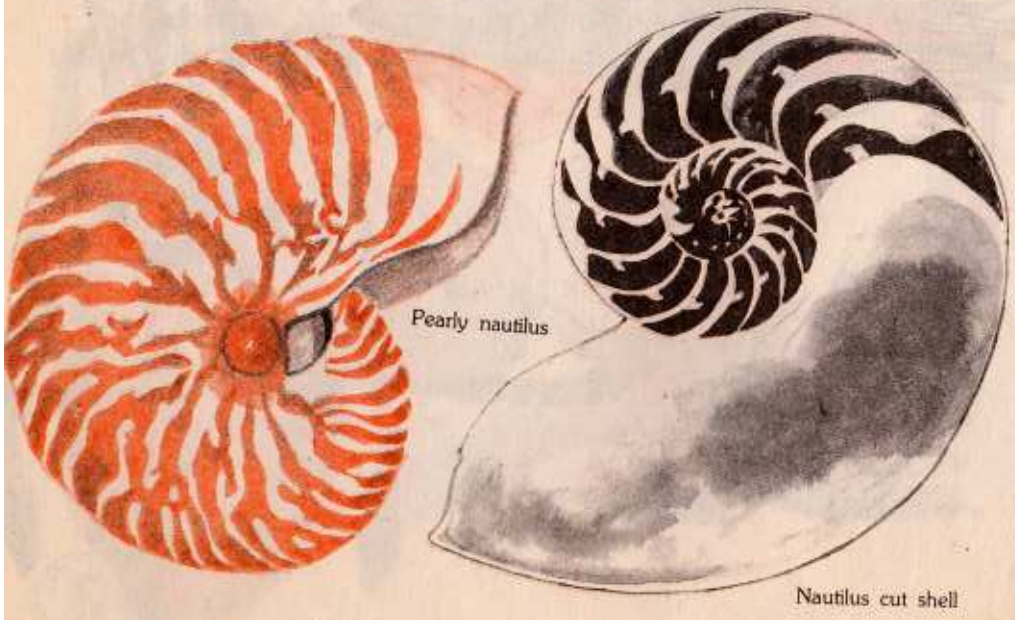
At first sight, no one would think that the shipworm is related to the clam. It bores into wood and lines its burrow with a limy tube. If you break this open, you can see a long, pencil-like, soft body. The burrow's opening is only a minute hole. At one end of the body are two very small valves which show that it is not a worm. It causes extensive damage to wooden jetties and boats.

Although squids and cuttlefish do not look like snails and clams, they are related to them. They are very active and intelligent. They have shield-shaped bodies, which are wide in cuttlefish but narrow in squids. Near the head are eight short and two long, fleshy arms on which there are many suckers. The animal presses these against its prey, creates a vacuum, and is thus able to hold its prey. When disturbed, squids and cuttlefish throw out an inky brown fluid. This makes the water turbid, giving them time to escape while their



enemy cannot see. Normally they swim horizontally with gentle, wave-like movements of the frilly border of the body, but they can also move fast by jet propulsion. Water is thrown out forcefully from a tube, the funnel, and this propels the animal in the opposite direction. The mouth has a beak, very much like that of a parrot, for cutting food. The eyes are well developed. The shell is hidden inside the body. In squids it is thin and transparent, and is called a pen. In cuttlefish it is limy but very light, as it is hollow. It is used by bird breeders to provide calcium in bird-feed, for that makes the egg-shells of birds strong.

Octopi have only eight arms and their bodies are rounded. They have no shell. They too can release "ink" and swim by jet propulsion. They like to live at one place, and if you see a pile of broken crab shells, it is a sure sign that an octopus's home is nearby. The mother octopus lays chains of grape-like eggs on the underside of stones and stands guard until they hatch. She will not feed all this time and dies soon after the babies are born.



Pearly nautilus

Nautilus cut shell

At first sight, the shell of the pearly nautilus looks like a typical snail shell. But when you see the animal inside, you know from its octopus-like shape that it is its cousin. The shell does not look very impressive, either in colour or in shape, having brown flame-like markings. Its beauty is only revealed when its outermost layer is removed by acid and when it is cut in half. There is a glistening mother-of-pearl sheen, and the shell is seen to consist of several chambers, increasing in size from the apex of the spire outward. The animal occupies only the outermost (largest) chamber. The other chambers are filled with a gas secreted by the animal, which keep it buoyant in water and prevent it from sinking.

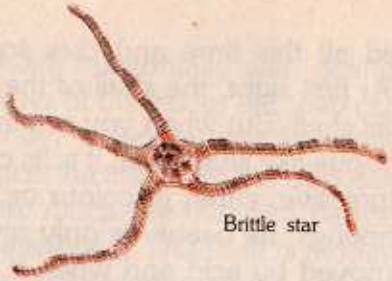
Starfish, Brittle Stars, Feather Stars, Sea Urchins and Sea Cucumbers

Symmetry in this group of marine animals is centred around the number 5; the arms, tentacles, etc. are either five or multiples of five. Tiny limy plates are embedded in the skin.

Starfish typically have five stout arms arising from a central disc (sometimes there are four or six). If an arm breaks, the starfish grows a new one. Not only this, but, in some varieties, if the broken arm has parts of the central disc attached to it, it will grow four new arms and a central disc so as to form another starfish! Oyster fishermen knew that starfish were enemies of oysters, but did not know the starfish's ability to grow new arms. When their nets brought up a starfish, the fishermen would chop it in two and throw it back into the sea, thinking they had killed it, little realizing that, in fact, they were helping the starfish to multiply.

The undersides of the starfish's arms have numerous soft, fleshy finger-like appendages called tube feet. Each of these is hollow and

Starfish



Brittle star

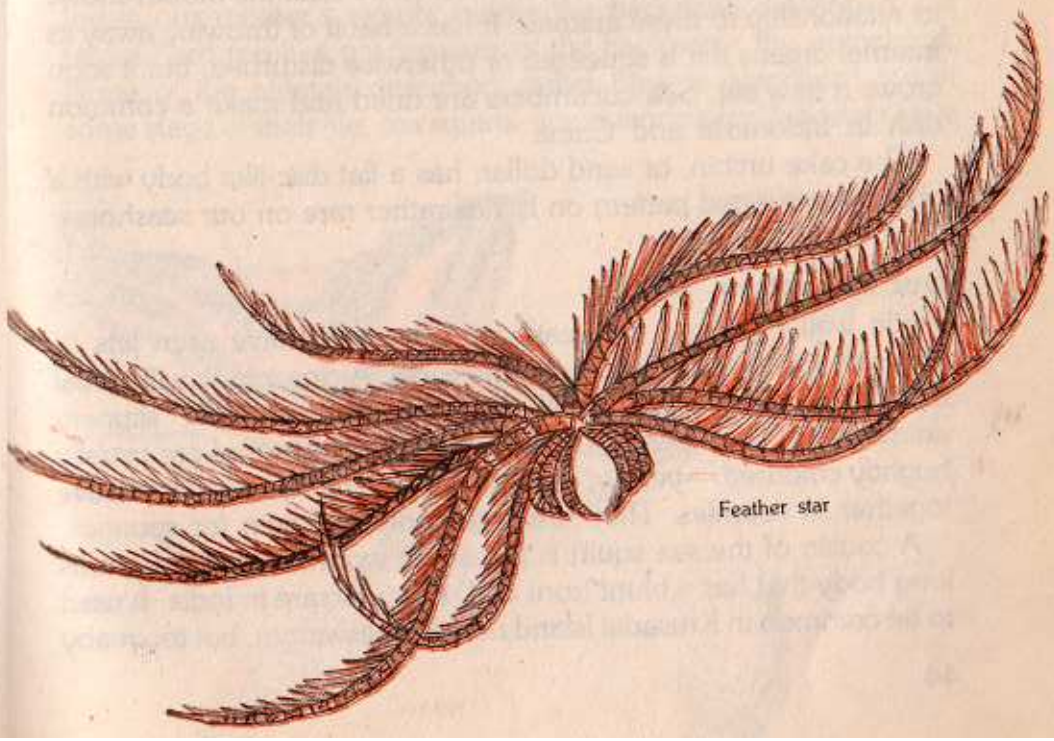
ends in a sucker. By pumping water in and out, the tube feet can cling to an object. The starfish uses its tube feet to walk, and also to catch its food. When it comes across an oyster or a clam, it wraps its arms around the shell and the tube feet exert a steady pull until the prey tires and opens its shell. Some starfish's manner of feeding is peculiar, even horrifying. They throw their stomachs out of their mouths onto the oyster's soft body, and pour out stomach juices which digest the prey. After they have finished their meal, the stomach is again pulled back.

Brittle stars look like starfish, but their central disc is much smaller, and the five arms are longer. Their name comes from the readiness with which the animal breaks off its arms—at the slightest touch or disturbance. Some brittle stars live on sea fans, wrapping their arms around the sea fan's branches. Their colour matches that of the sea fan so well that one has to look carefully to see them. Other brittle stars live almost completely buried within the crevices of sponges.

Feather stars resemble brittle stars, but the arms have long offshoots which give the appearance of feathers. On the underside are short appendages which can be curled, like a finger, around a pebble, or a support for the feather star to rest. A feather star in

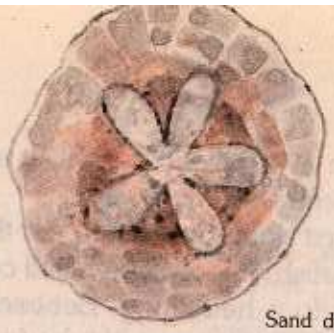
motion is a delightful sight. It sways its arms like a ballet dancer, and gently swims away.

At first sight, one would not think that the sea urchin is related to the starfish. It looks like a ball covered with long spines, somewhat similar to a hedgehog. Between the spines, if you look carefully, you will see ten rows of tube feet. In some sea urchins these spines are poisonous, so one should pick up the animal with care. With this array of spines, one would think that the sea urchin is invulnerable, but some fish eat them greedily. A triggerfish will take a sea urchin in its mouth and shake it, as a dog does a rat, till the spines fall off. With its strong teeth, the fish crushes the sea urchin's shell and gobbles up the soft inside. The sea urchin's shell—more



Feather star

Sea urchin



Sand dollar

properly called "test"—is very pretty, with several rows of knobs arranged in a regular pattern in the typical multiple of five. The spines of one kind of sea urchin are used by school children as pens for writing on slates.

Sea cucumbers have elongated bodies, which bear little resemblance to the starfish and its cousins. But a look at the five rows of tube feet and ten branched tentacles near the mouth shows its relationship to these animals. It has a habit of throwing away its internal organs if it is squeezed or otherwise disturbed, but it soon grows a new set. Sea cucumbers are dried and make a common dish in Indonesia and China.

The cake urchin, or sand dollar, has a flat disc-like body with a pretty star-shaped pattern on it. It is rather rare on our seashores.

Our Ancestors

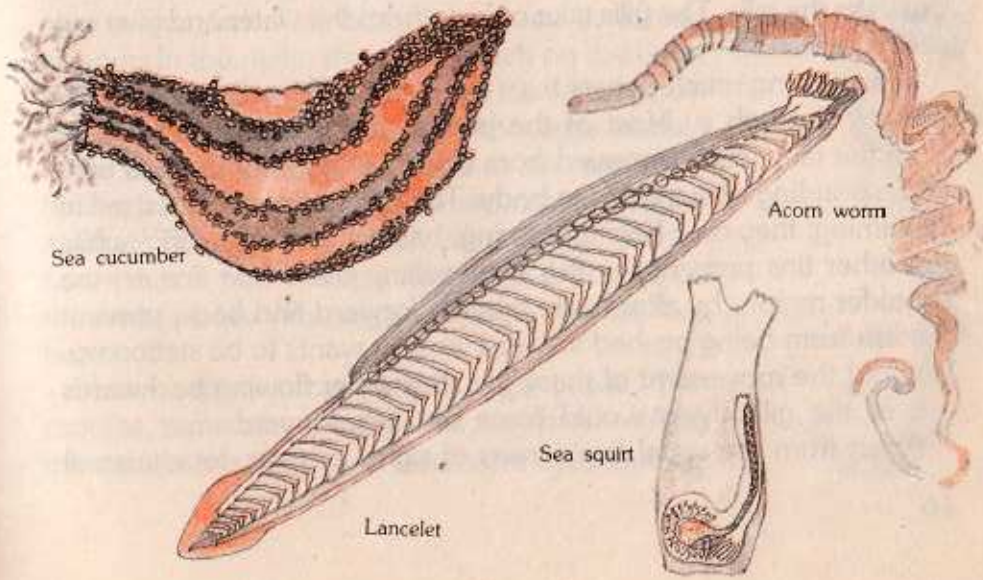
While walking along the seashore you might have seen jets of water shooting out from among the rocks. A closer look will reveal that they come from small, barrel-shaped, smooth, slippery animals with two openings. These are sea squirts, and are usually brightly coloured—yellow, orange, red or pink. Some of them live together in colonies. They are commonly mistaken for sponges.

A cousin of the sea squirt is the acorn worm, so called from its long body that has a blunt front end. It is now rare in India. It used to be common in Krusadai Island near Rameswaram, but too many

people, collecting too many specimens, brought it to the brink of extinction. It is now rigorously protected.

Yet another ancestor of ours is the lancelet. It is shaped somewhat like a fish, and has a fin on the back as well as a tail fin, but no head. It can be easily distinguished by the series of V-shaped muscles running along its flanks. It is quite common at some tide-bars along the east coast, yet we rarely see it as it remains buried in the sand. Stamping the ground hard sends the lancelet into a panic and it will jump out of the sand before again digging in.

You must be wondering why I have called this section 'Our Ancestors'. We humans have a backbone, but when we were still inside our mother's womb, before the backbone developed, we had a hard rod-like predecessor of the backbone, the notochord. None of the animals described earlier have a notochord but at some stage of their life, sea squirts, acorn worms and lancelets have



a notochord. These three, therefore bridge the gap between the animals without backbone and the higher evolved (backboned) animals like fish, frogs, reptiles, birds and mammals.

Fishes

The first thing that comes to our mind when we see fishes is their value as food. Many kinds of fish are, of course, eaten, and are therefore well known to us, but there are many more kinds that are not readily seen and are therefore not well known. There is a great deal of variety in the shape, colour and behaviour of fishes.

Fishes have thin, membranous projections on their bodies called fins. There is one fin at the end of the tail, one or more on the back, one on the belly in the midline, and two pairs on the regions corresponding to our shoulder and hip. (Of course, fishes do not have shoulders and hips.) They breathe through their gills—arched organs with numerous hair-like offshoots richly supplied with blood. The fish takes in water, closes its mouth and forces it out over the gills. The gills take oxygen from the water and give out carbon dioxide.

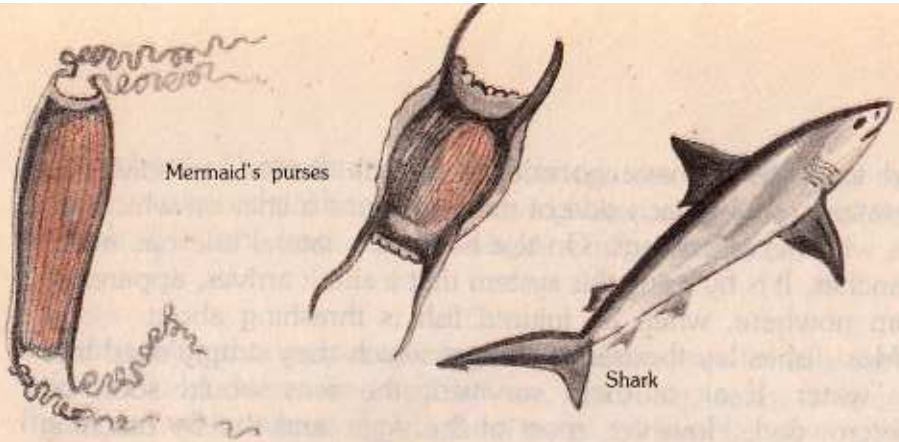
Water being much denser than air, fishes are ideally adapted for moving through it. Most of the power during swimming comes from the tail, which is moved from side to side, accompanied by a corresponding swaying of the body. The paired fins are not used in swimming; they only help in steering, balancing and braking, while the other fins prevent the fish from rolling over. The fins on the shoulder region, by alternately moving forward and back, prevent the fish from being pushed forward when it wants to be stationary. Without the movement of these fins, the water flowing backwards out of the gill-covers would force the fish forward.

Apart from the usual five senses of sight, hearing, touch, smell and taste, fishes have an additional sixth sense—sensitivity to vibrations. Along each side of the body runs a line, on which are pits with nerve endings. On the head, this lateral line has many branches. It is by using this system that a shark arrives, apparently from nowhere, when an injured fish is thrashing about.

Most fishes lay thousands of eggs which they simply shed into the water. If all of them survived, the seas would soon be overcrowded. However, most of the eggs, and the fry hatching from them, are eaten by enemies, and only a couple or so reach maturity. Some fishes do not lay eggs, but give birth to young. But they are not mammals, as they do not suckle their young (feed milk). Others lay only a few eggs but take care of them and the babies. One example is the sea horse. Seeing it, we would not imagine that it is a fish. It looks more like the knight in a game of chess. The head resembles that of a mythological horse. The tail is long, like a monkey's, and can be curled around a twig or sea fan. The body is encased in a hard armour. In the male, there is a pouch on the belly, like a kangaroo's. While mating, the female puts her eggs into the pouch, and the eggs remain there until they hatch. It is odd to see sea horse babies being born from the father, rather than the mother! The pipe fish, which is a cousin of the sea horse, has a pair of flaps, instead of a pouch, on the male's belly. The eggs are kept here till they hatch.

Sea horse

Many catfishes carry their eggs inside their mouths, remaining hungry until they hatch. When the catfish is caught and landed, it spits out the



marble-sized eggs in its death throes. Parental care in the air-breathing dwarf gourami and Indian paradise fish goes much further. When the male is ready to mate, it makes a nest by blowing hundreds of sticky air bubbles from its mouth. It then entices a female under the nest and coaxes her to lay eggs which it picks up in its mouth and blows into the bubble-nest. Thereafter it drives away the female and guards the nest against enemies. Eggs or fry falling out of the nest are picked up and spat back into it until the young are big enough to fend for themselves.

It may surprise you to know that all fishes do not have bones in their bodies. Sharks and their relatives have skeletons made of gristle (cartilage, similar to that in our ear lobes or the tip of our nose). There are many kinds of sharks, ranging in length from 30 cm to over 15 metres. Only a few varieties are man-eaters, such as the Great White Shark which grows to six metres. But it is inadvisable to tease any kind of shark, as even a 1.5-metre one can nip off a sizeable chunk of flesh. Their teeth grow in several rows and, if one gets broken off, another will move forward to take its place.

Sharks that do not live on the sea bottom must always swim, so that water enters their mouths and passes over the gills. In aquariums and oceanariums, if a shark is exhausted and sinks

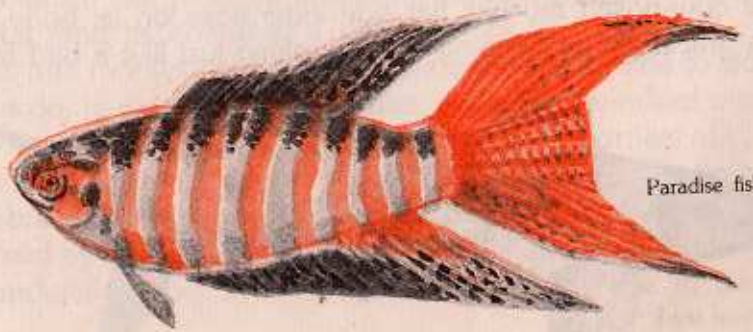
motionless to the bottom, a diver will hold it carefully and walk with it so as to keep water bathing the gills until it revives. Even when asleep, a shark swims lazily, unlike most other fishes.

Some sharks live on the sea bottom. They do not have to swim all the time. They lay eggs in capsules called the "mermaid's purse". These have thread-like extensions at the corners, which get entangled and anchor the purse. The young grow for many months in the purse until they are ready to hatch.

On the skin of sharks are scales similar to their teeth but much smaller. They slope backward, so if you stroke a shark from the mouth towards the tail it feels smooth, but stroking it from the tail to the head the surface seems very rough, like sandpaper. In earlier days sharkskin, known as shagreen, was used as sandpaper for polishing wood. Nowadays it is used as high quality leather for shoes, handbags and purses.

The liver of sharks contains oil, which is rich in vitamin A. Shark liver oil is a tonic and is good for those suffering from night blindness.

Surprisingly, the largest of all sharks, the whale shark, is harmless to man. It is docile and even allows us to touch it. The back of its

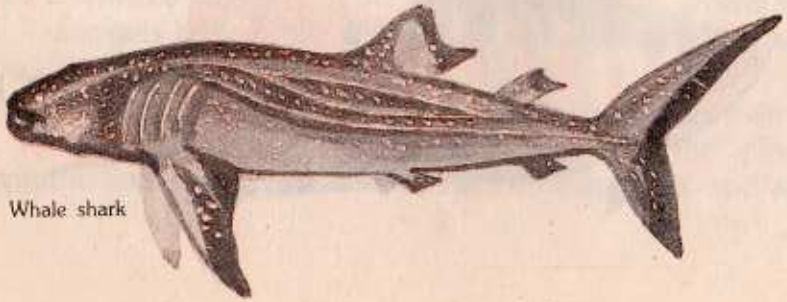


gills act as a filter. The whale shark swims with its mouth open, taking in tiny animals along with the water; the water filters through, and the animals are retained and swallowed.

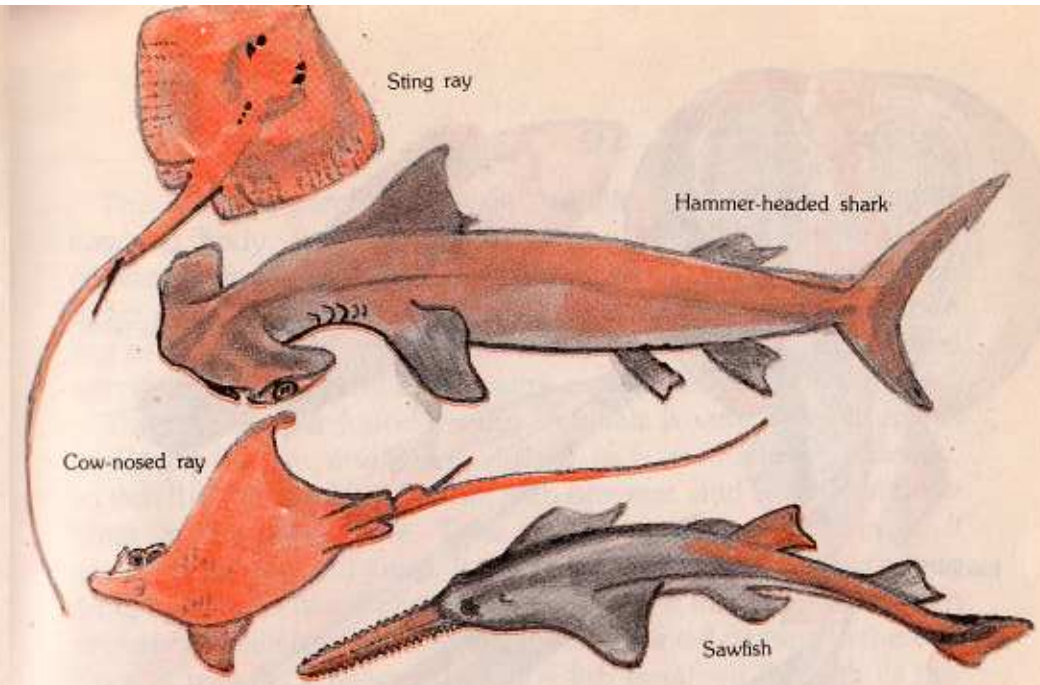
In the hammer-headed shark, the head is shaped like the letter T, with the eyes at the tips. The sawfish has a long snout at the end of its mouth, with many teeth lining it. It is said that it swims into a shoal of fish and sways its head from side to side, to cut its prey into pieces before swallowing them.

Their cousins, the sting rays, do not resemble sharks at all. They have a flat, kite-like body and a long tail, with eyes situated at the top, while the mouth, nostrils and gill-slits are on the lower side. Behind the eyes are a pair of openings constantly opening and closing. Water enters here and goes out from the gill slits. At the root of the tail is a spine (sometimes there are two or more) with minute saw-like teeth along the sides. When the fish feels threatened, it moves its tail like a whip, and the spine can cause a jagged wound. When fishermen catch sting rays they, therefore, first cut off the spines. Moreover, the spine has venom glands on its sides, and the poison from these causes a great deal of pain and agony. The sting ray's body is dark brown on the upper side, matching the colour of the muddy sea bottom where it lives and feeds. The underside is white.

The cow-nosed ray has flat side extensions on its body, and swims gracefully by flapping these, looking just like a bird flying.



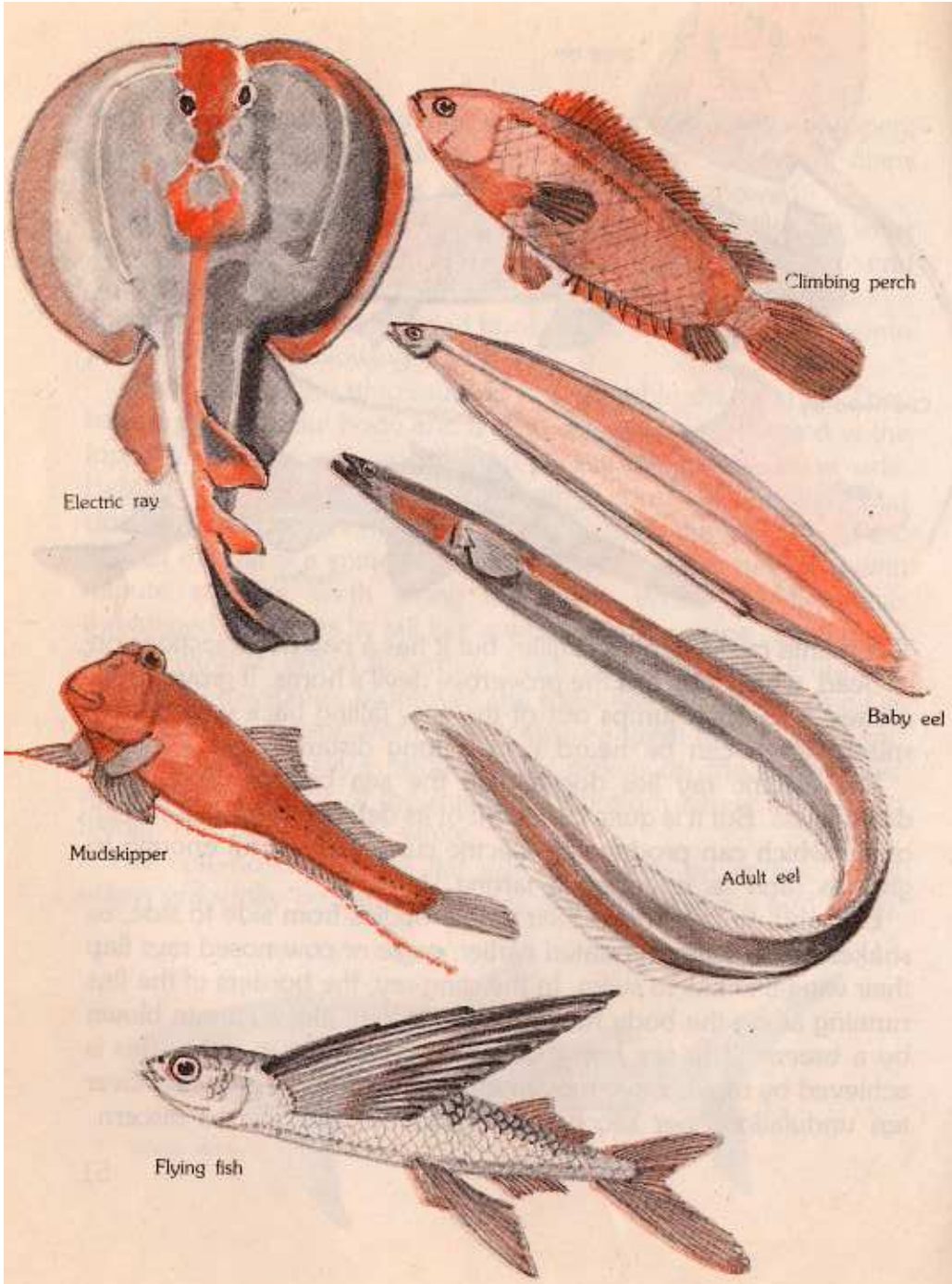
Whale shark



The manta or devil ray is similar, but it has a pair of projections on its head, which look like the proverbial devil's horns. It grows to six metres, and often jumps out of the sea, falling back with a loud splash which can be heard over a long distance

The electric ray lies docilely on the sea bottom, apparently defenceless. But it is quite confident of its defence system. It has an organ which can produce an electric current powerful enough to give us (and its enemies) a jarring shock.

Eels and morays move their whole bodies from side to side, as snakes do, to swim. As stated earlier, eagle or cow-nosed rays flap their wing-like fins to swim. In the sting ray, the borders of the fins running along the body move up and down, like a curtain blown by a breeze. The sea horse does not use its tail to swim; this is achieved by rapid, wavy movements of the fin on the back—over ten undulations per second, too quick for our eye to discern.

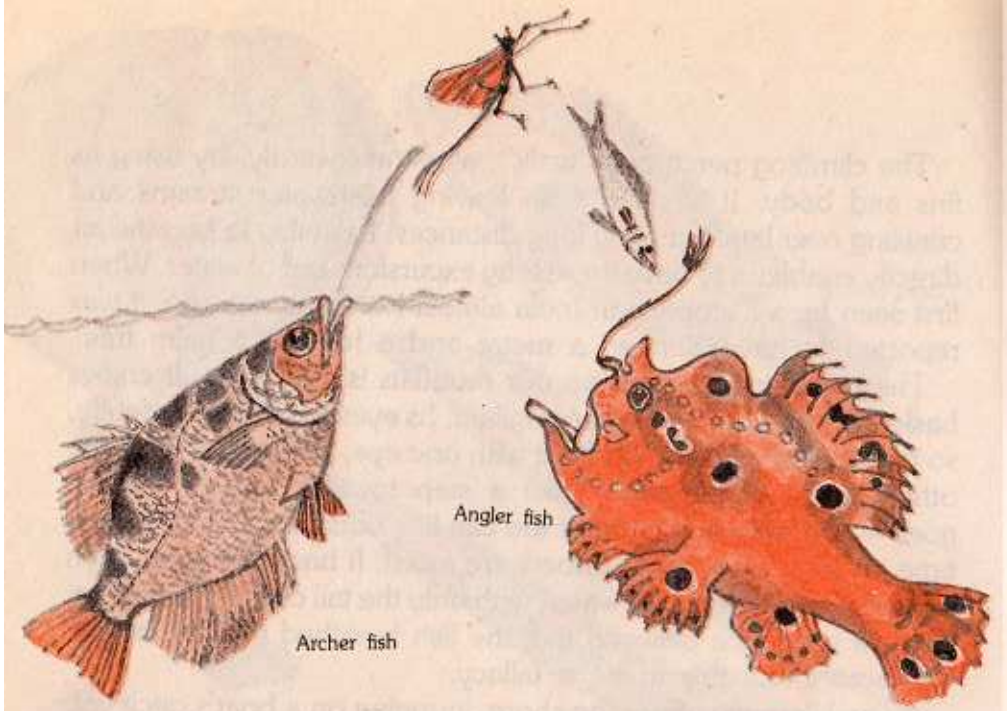


The climbing perch can "walk", albeit awkwardly, by using its fins and body. It is often seen leaving freshwater streams and crawling over land for fairly long distances. Its ability to breathe air directly enables it to have these long excursions out of water. When first seen by a European in India almost two centuries ago, it was reported to have climbed a metre and a half up a palm tree!

The mudskipper found on our mudflats is very agile. It enjoys basking in the sun, and is very vigilant. Its eyes turn independently, so that the fish can look in front with one eye, and behind with the other at the same time. Take a step towards it and away it goes—hop, skip and jump. It too can live outside water for a long time, as long as its gill chambers are moist. It has often been seen almost completely out of water, with only the tail dipping in the sea. Thus, it was once believed that the fish breathed through its tail. We now know this to be a fallacy.

A few kilometres from the shore, lounging on a boat's deck you might have seen the flying fish's long flight. It can leap out of the water for distances as much as 360 metres and at heights as much as nine metres. It does not fly, only glides. The lower lobe of its tail fin is longer and thicker than the upper one and, by moving it vigorously from side to side, the fish builds up speed at the sea surface. As its body leaps into the air, it extends its long fins, which act like the wings of a glider. Contrary to popular belief, the fins are not flapped like the wings of a bird, though they sometimes appear to do so as they vibrate in the wind. A flight may last as long as 40 seconds.

Fishes get their food in many ways. The hunters use their speed to chase and catch their prey. The lurkers sit motionless waiting to pounce on their prey, their body colour matching their background and concealing them. Some fishes have devised clever ways of



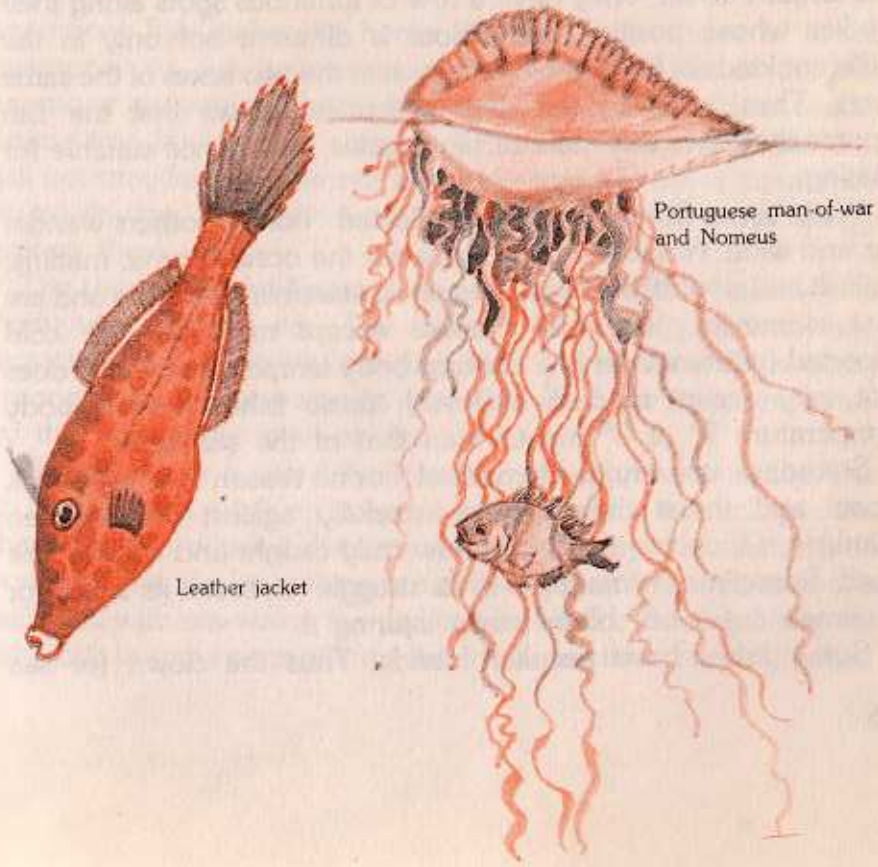
catching food. The angler fish has a spine on its head, ending in a tassel. This is normally kept pressed flat against the head, but, when the fish is hungry, it lies motionless and moves the spine to and fro. A curious fish, thinking this is a wriggling worm, comes close to investigate, and the angler fish gulps it down.

The archer fish actually shoots its prey with bullets of water. The roof of its mouth has a groove, and when the tongue is pressed against it, it forms a tube. On seeing an insect resting on a plant above the water, the fish aims pellets of water at it and brings it down to be eaten.

The Portuguese man-of-war's tentacles are so deadly that on mere contact with them most kinds of fish die. Yet the leather jacket fish breaks off these tentacles and eats them, without any ill effect.

Among fish, the cleaner wrasse is a doctor-cum-dentist like the cleaner shrimp. It selects a stone or piece of coral and stays there. Sick fishes come to know of this place and visit the "clinic". To indicate that they need the cleaner fish's help, they may change colour or stand on their heads. The cleaner wrasse goes over the patient's body and picks off parasites or pieces of infected skin around wounds. It will also pick off parasites from the gills and go inside the patient's mouth. If the cleaner wrasse is busy attending to a fish, other fishes will patiently await their turn.

Man uses fishes to fight disease too. Malaria is caused by



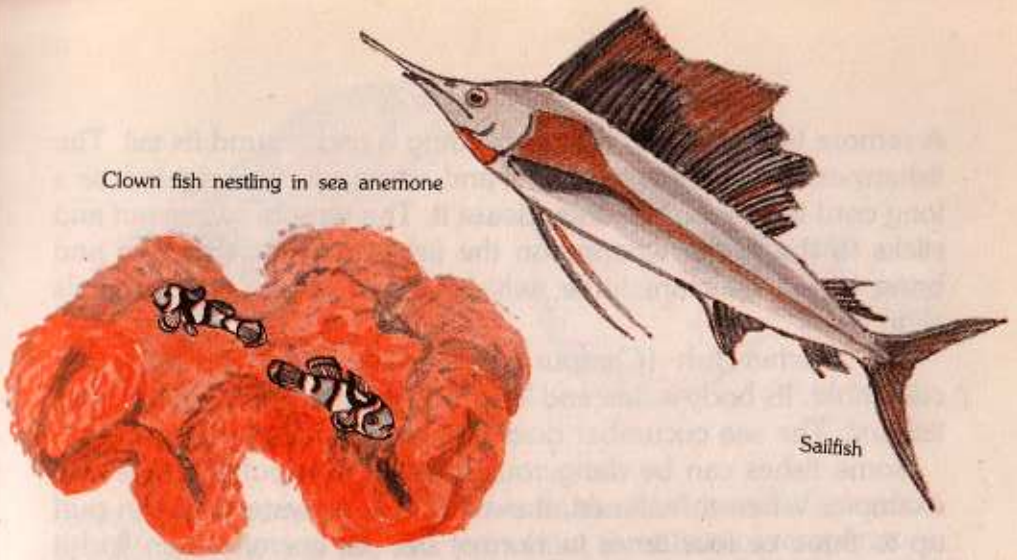
mosquitoes, which breed in stagnant water. Guppies and *Gambusia*, native fishes of North America, have been introduced into India, as they feed on mosquito larvae and thereby help eradicate malaria. Similarly, other fishes feed on the copepods which harbour the parasite causing guineaworm.

Many fishes living in the deep sea produce light. And, unlike our fluorescent tubelights and incandescent bulbs, which waste a lot of electric energy as heat, the light produced by these fishes (and also by many other animals like comb-jellies, worms, prawns, squids, sea squirts, etc.) uses energy very efficiently, with no heat. Hence it is known as cold light. Typical of fishes having this kind of light are the lantern fishes. They have a row of luminous spots along their bodies whose position and colour is different not only in the different kinds of lantern fish, but even in the two sexes of the same kind. Thus, even in the dark a female knows that the fish approaching her is a male of her species, and hence suitable for mating.

While some fishes stay near a selected "home", others wander far and wide. Notable among these are the oceanic tuna, marlins, sailfish and swordfish. They have sleek, streamlined bodies and are fast swimmers. While all animals except mammals are cold blooded (mammals have a uniform body temperature which does not vary except in case of fever), these fishes have a body temperature 7° or 8° higher than that of the sea-water.

Swordfish are very bad tempered. For no reason they will attack boats and thrust their snouts forcefully against the wooden planking. Of course the fish is now truly caught and cannot free itself. Sometimes it manages in its struggle to break its snout, or boatmen cut it off, often fatally injuring it.

Some fishes have peculiar friends. Thus the clown (or sea



Clown fish nestling in sea anemone

Sailfish

anemone) fish makes its home among the tentacles of a sea anemone. As we have seen earlier, the tentacles of the sea anemone are equipped with stinging cells which can inject deadly poison into fish or other animals. Yet the clown fish is immune. It will not stray far from the sea anemone, and whenever threatened by an enemy, it will swim up to the tentacles and nestle snugly among them.

The sheppard fish (*Nomeus*) has a still more deadly friend—the Portuguese man-of-war. The latter is also equipped with long tentacles bearing deadly stinging cells, yet *Nomeus* lives cosily among them. *Nomeus* attracts other fish which are killed and eaten by the Portuguese man-of-war.

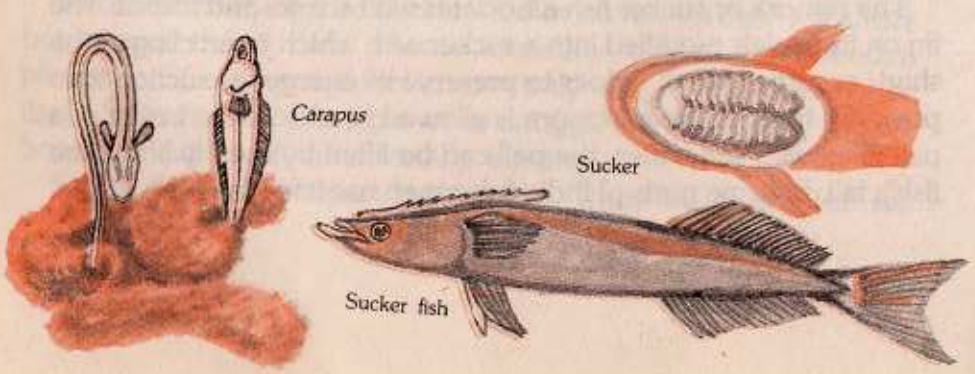
The remora or sucker fish associates with sharks and turtles. The fin on its back is modified into a sucker with which it can cling to the shark or turtle, which it does to preserve its energy. Its suction is so powerful that, if a large remora is allowed to stick to the inside of a pail filled with sea-water, the pail can be lifted by merely lifting the fish's tail. In some parts of India fishermen use it for catching turtles.

A remora is caught and a loop of string is tied around its tail. The fishermen take it out in their boat and, when a turtle is sighted, tie a long cord to the remora and release it. The remora swims out and sticks to the turtle, whereupon the fishermen pull the cord and bring in the reluctant turtle, which cannot escape the remora's clutches.

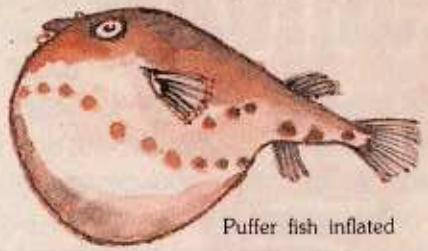
Yet another fish (*Carapus)* lives inside the body of a sea cucumber. Its body is thin and long, and it enters the sea cucumber tail first. The sea cucumber does not seem to mind this intrusion.

Some fishes can be dangerous to man. The puffer fish is one example. When threatened, it swallows air or water and can puff up to three or four times its normal size. Its enemies then find it difficult to swallow. Its flesh can safely be eaten, but its liver, skin, intestines and roe are extremely poisonous. In Japan, restaurants are not allowed to serve this fish unless the cook has a diploma from a special catering college, where he is taught to carefully remove the dangerous organs. In our country, whenever fishermen catch puffer fish in their nets, they throw them back into the sea.

Some fishes living in coral reefs are usually safe to eat, but sometimes are poisonous. The poison is not produced by the fish itself. When it eats certain noxious animals (mainly dinoflagellates), though it is not harmed itself its body absorbs the prey's poison. When it is eaten by man, we suffer from weakness, pain in the joints, blurred vision, severe vomiting and diarrhoea. In severe



Puffer fish


Puffer fish inflated

cases it can lead to paralysis and even death. A peculiar symptom of such poisoning is the reversal of the sensation of temperature, thus drinking hot tea feels as cold as sucking ice, while ice-cream and even cold water appear to burn the tongue. Those so affected cannot even bathe with cold water. There is no chemical test to find out if a fish is safe to eat. The barracuda is to be avoided as it usually conveys this poison.

Then there are fishes which are venomous. (If we fall ill after eating or drinking something, it is poisonous. When something gets into our blood and we suffer, it is venomous.) The spine of the sting ray has already been mentioned. Some other fishes have venom glands on their fin spines. The spines of the fins on the back and shoulder region in catfishes are usually venomous, and a cut from even a dead fish is painful. So also are the spines on the hip region of the rabbit fish (also called the jigsaw puzzle fish). The turkey fish is aptly named. It has flamboyant, long, frilly spines set like a collar around the neck, looking like a bird's feathers. When approached, it does not flee, but spreads these fins like a fan and raises the spines on its back. The latter have venom glands at their base, and the venom can be injected as with a hypodermic syringe. A jab is

extremely painful and may even require a stay in hospital. The fish is also called the lion fish, as the frilled collar around its neck looks like a lion's mane.

The beauty of the turkey fish raises a question. What is its purpose? In nature, most animals have a body colour that tends to blend with the background. Being inconspicuous, they can escape detection by their enemies. Animals which are poisonous, venomous or with a disagreeable taste advertise the fact by having bold, glaring colours or bizarre shapes.

If the turkey fish is pretty, the stone fish is horribly ugly; but it is superbly camouflaged. It sits motionless on the sea bottom in shallow water, and is therefore likely to be trodden on. Then the venom on its fin is injected. Many a time its sting is fatal.

Some fishes are revered by man, on account of some peculiarity in colour pattern or structure. The young of the Koran Fish have an irregular pattern of white dots and stripes on the tail. In a few specimens, these, with a little stretch of imagination appear to form the Arabic words *Shan-e-Allah* (Glory of God). These are in great demand with Muslims. If you notice carefully, the bones on the lower side of the skull of some varieties of marine catfish vaguely resemble a cross with Jesus Christ crucified on it. The bones for hearing form a halo around his "head", and the rattling of the small bones inside the fish's skull can be likened to the dice with which the soldiers cast lots for the garments of Christ.

Frogs, Toads and Newts

Everyone knows about frogs and toads, but many do not know the difference between them. Both have webbed hind feet which are much longer and stouter than their front ones. This enables them to jump. Frogs have smooth, shiny skins and slim waists, while

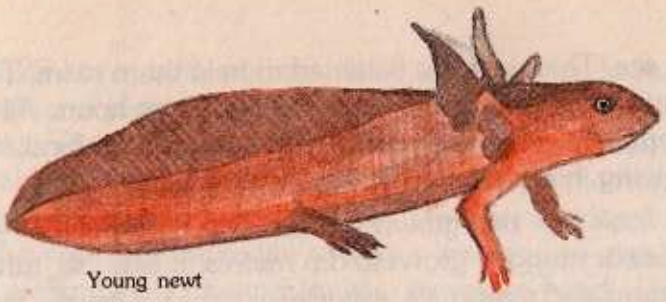
Frog

toads have a more hunched-back appearance, with a rough, warty skin and a broad waist. Frogs have small teeth in their upper jaw, but toads are toothless.

In toads, the sides of the head or body have glands which give out an acrid, toxic secretion. Animals therefore avoid catching them. Toads live on land more than frogs, but lay long strings of eggs in fresh water. Frogs spend more time in water, and lay their eggs in loose clumps. The corrugated frog spends its entire life in water. While adult frogs and toads breathe air through their lungs and are tailless, their babies, called tadpoles or polywogs, breathe by means of gills, have long finned tails, and look somewhat like fish. At first they do not have limbs but, as they grow, limb buds appear and slowly lengthen while the tail shortens and finally disappears. Tadpoles are vegetarian, and have long coiled intestines. These end in the middle line of the body in toads, but are slightly to the right of the midline in frogs.

Frogs consume insects, freshwater crabs and small fish, and are very useful to the farmer, as they control these pests in his fields.

At first sight, newts look like lizards, but they have a smooth skin without scales, and no claws on the feet. Only one kind of newt is



Young newt

found in India, in Darjeeling and Sikkim in the eastern Himalaya. It is not striking in appearance, being blackish brown with a thin yellow or orange stripe on the belly. It grows to 15 cm. When excited, it exudes a toxic slime.

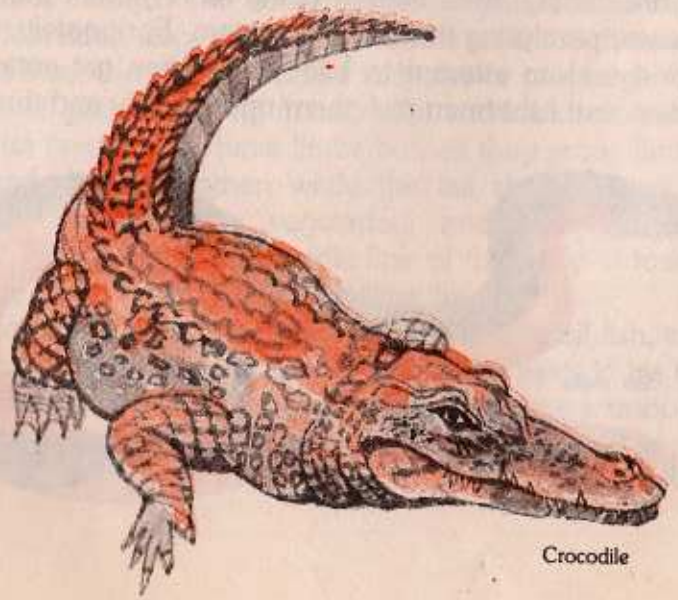
Snakes, Crocodiles and Turtles

The creatures listed above are all reptiles and breathe through their lungs. Most snakes live on land, but a few live successfully in water. Snakes living in fresh water are non-poisonous, but those in the sea are deadly, their venom being more potent than that of land snakes, paralysing the nervous system. Fortunately, they are docile and seldom attempt to bite. They often get entangled in fishing nets, but fishermen pick them up fearlessly and throw them

Sea snake

back into the sea. Their tails are flattened to help them swim. They breathe air, but can remain submerged for over three hours. All sea snakes, except the sea krait which lays eggs on land, are viviparous, giving birth directly from the mother's body.

Crocodiles look like overgrown lizards. The commonest—the marsh crocodile or mugger, grows to 3.5 metres. It eats fish, turtles, crabs, cormorants and mammals (especially otters). It usually walks with its belly brushing the ground, but sometimes does a "high walk" with the legs straight. Swimming is done with wide strokes of the powerful tail. It likes to bask in the sun with its mouth wide open (to regulate its body temperature and dry out parasites). The crocodile can live for over a hundred years. It breathes air but can remain submerged for long periods, coming up several times an hour for air. The mother digs a hole in the river bank where she lays up to 50 eggs. The young hatch in two months and make feeble sounds—umph, umph, which are a signal for the mother to dig them out and carry them in her mouth to the water. They are



Crocodile

only 25 cm at birth and are likely to fall a prey to lizards, snakes, jackals and pigs. They, therefore, stay with their mother for a few weeks. They feed on insects, frogs, fish and snakes. Muggers are sociable and live in groups of 20 to 30. Only a mother guarding her nest or young and an occasional maneater are dangerous to man.

The saltwater crocodile is bigger, growing to eight metres, and has a slimmer body and longer, narrower head. They are more solitary than the mugger. In summer, the mother makes a mound a metre high and two metres wide by piling up vegetation and earth where up to 90 eggs are laid. They hatch in 75 to 80 days, when the mother digs out the young and takes them into the water. The young are bright yellow and black. Adults feed on fish, crabs, lizards, deer and pig, and are large enough to be maneaters.

The gharial is the most water-loving of Indian crocodiles, and grows to seven metres. It gets its name from the prominent hump at the end of the male's snout which resembles an earthen pot (called a *gharha* in Hindi). It feeds on fish and can be distinguished by its long, slender jaws, bulging eyes, and olive green body. It lays 40 to 80 eggs in a hole in March, and the young hatch in June. A male, several females and sub-adults can be found together.

Turtles are aquatic relations of tortoises and breathe air through their lungs. They have flatter bodies and webbed feet. The body is

Terrapin

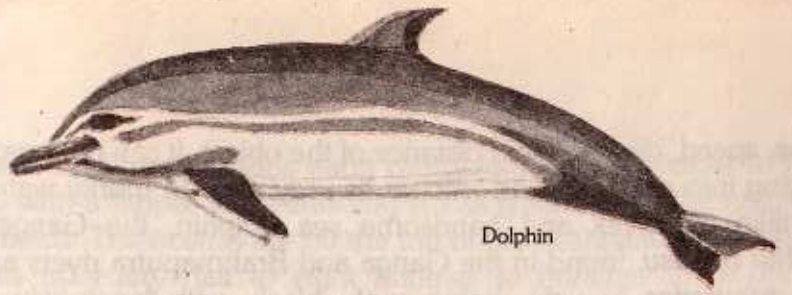
completely covered by a "shell" with holes only for the head, legs and tail.

The freshwater terrapins live in water during the day but come on land at night. Their diet is mixed but they prefer plants. The female lays white, oval, brittle eggs. Many terrapins are brightly coloured; the tent turtle, which has a red spot on its head, is a popular pet. The box turtle found in the Great Nicobar Island has a hinge which divides its under-shell into two movable flaps. The riverine Balagur grows to 50 cm, and the female is thrice as big as the male. Soft-shelled turtles have skin growing over the shell. They have long, flexible necks and can bite viciously. They are often seen in temples, as they are one of the ten *avatars* of Vishnu.

Sea turtles have flat, paddle-like flippers for swimming, and spend almost their entire lives in the sea. Only the female comes on land to lay eggs. She comes at night, digs a pit in the sand, and lays 50 to 200 eggs. These are round, the size of table tennis balls, and have a thin, papery shell. The mother sheds copious tears while on land to protect her eyes from drying up and to wash away any sand grains in them. The young hatch in two months and scamper to the sea. If the temperature of the incubating eggs is too low, all the babies will be male. If it is too high, all will be females and if it is just right there will approximately be an equal number of males and females. (The sex of a crocodile is also determined by temperature.) The breeding of the Olive Ridley turtle in Orissa is a spectacular sight; in February, on a ten-kilometre stretch of seashore, up to 200,000 females come in a period of a fortnight.

Mammals

The otter has a long, compact body, like the mongoose. But the tail is broad and the toes are webbed to help in swimming. It is an agile



Dolphin

swimmer and can twist and turn to catch fish and water fowl. The body is covered with short, velvety hair which traps air and keeps it warm in water. The nostrils and ears can be closed when under water. The otter is 100 cm long, including the tail. The blind, helpless young are born in a hole in the stream bank. Fishermen in Orissa use tame otters to drive fish into their nets.

Dolphins and porpoises look very much like fish but, while a fish's tail fin is vertical, their tail flukes are horizontal. The skeleton of their flippers is similar to our hands. Dolphins have a long, beak-like snout, while porpoises have blunt, round snouts. They are mammals and breathe air through a blowhole situated on the top of the head. They rise to the surface of the water to breathe and then expel the used warm air from their lungs through the blowhole.

The Indian dolphin, found in shallow seas, grows to 2.75 metres, has a purple-grey back and white belly, and feeds on fish and squid. It usually swims in schools of two to six. It has a fin on the back. The finless black porpoise is smaller, growing to 1.5 metres, and it has peg-like teeth.

Dolphins communicate with each other by emitting clicks. They are very intelligent, and it is believed that they have a language. What is more, sound is used, as with bats, for echo location. The dolphin emits a series of pulsed clicks which, when they strike an object, bounce back and are "heard", not by the ears but through the jaw and throat. From the echo a dolphin can judge the size,

shape, speed, direction and distance of the object. It can thus avoid banging into obstacles and catches its prey even in murky water.

Unlike the sleek and handsome sea dolphin, the Gangetic dolphin or *susu*, found in the Ganga and Brahmaputra rivers and their tributaries, is ugly, being sooty black, with loose skin, is humpbacked, with beady eyes, a short neck, and has a long snout. The eyes have lost their lenses, and the *susu* is blind. But, like dolphins, it has an efficient echo location system. During the day it stays in deep water, but at night it comes to water as shallow as 30 cm to hunt prawns and bottom fish. It usually swims with its body inclined to one side, with a flipper and half its tail out of the water. It grows to 2.5 metres and gives birth to young from April to July. It is now extremely rare and is in danger of extinction.

The dugong or sea-cow grows to three metres, weighs 400 kg, feeds on sea grasses and is found in the Gulf of Mannar, Kutch and the Andaman Islands. The upper lip, in the form of a horseshoe-shaped fleshy pad, overhangs the lower lip and has stiff bristles. The male has tusks on its upper lip. The eyes are small and beady. The female's breasts are in the region of the chest between the flippers, and the mother's habit of holding the baby close to her body with a flipper while suckling it, has given rise to the myth of mermaids. The nostrils are on the top of the head, and the dugong comes up every half to eight minutes to breathe.

Dugong

Fish Migration

Some fishes, like sharks and tuna, roam over vast stretches of the ocean. But these are not migratory fish. A migrating animal will travel from one place to another particular place and then return to the original place; usually the migration is for the purpose of breeding.

A classic example of fish migration is the eel. Juvenile eels grow in rivers, and when adult swim downstream and enter the sea. They breed at great depths in the ocean. The young, called elvers, which hatch from the eggs laid deep in the ocean, are transparent and leaf-like. As juveniles, they are long with a tubular body, and swim back towards land, enter the mouths of rivers and swim upstream. Eels from Europe and the east coast of America breed in the Sargasso Sea, and the young have to travel hundreds of kilometres to reach fresh water. The Indian eel is related to the American and European eel but we have no idea where the Indian eel goes to breed.

Salmon breed in freshwater streams and rivers. In many species, the adults die after mating. The young live for some time where they are born, and then travel downstream until they reach the sea. For several years they will live there, but ultimately they feel the urge to migrate and come close to the shore. They unerringly make their way to the same river they had lived in when young, and will ascend it, to mate in the same shallow stream they were born in. It is believed that they find their birthplace by the smell of the water.

The Indian Shad (Hilsa) is similar to the salmon, as it, too, lives in the sea but ascends rivers to lay its eggs.

Whales also migrate between their feeding regions, located in the cold polar seas, and breeding sites near the tropics.

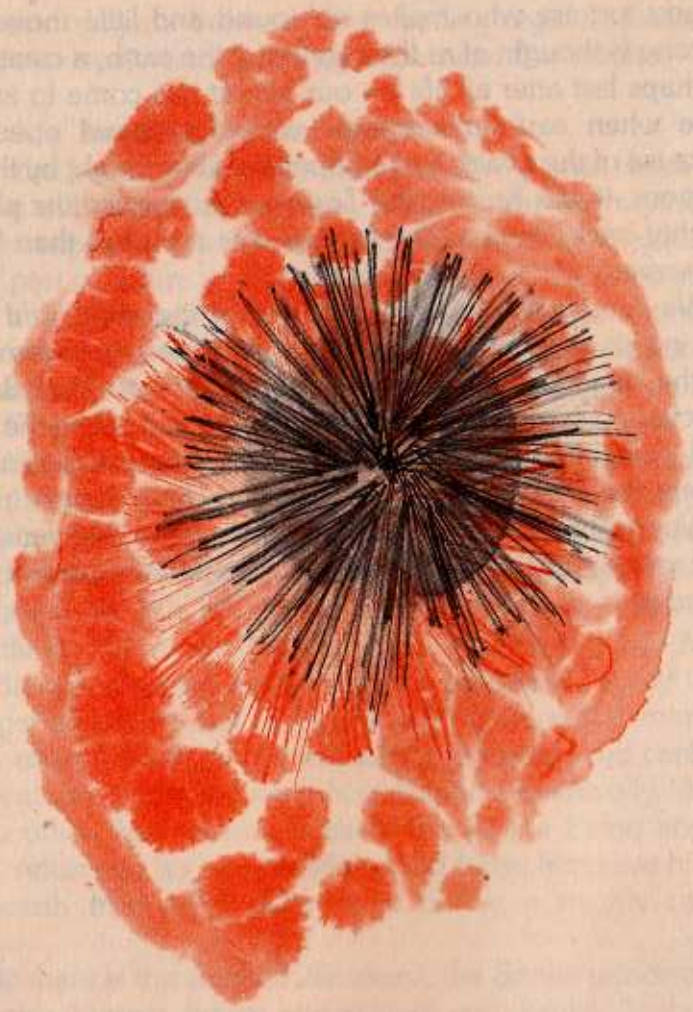
Man and his Aquatic Environment

We share the earth with many forms of life; plants, birds and animals are our companions. Many stories from our mythology and folklore express the understanding and realization that human beings are part of nature and not separate from it. There are stories that tell of how life began and evolved in the primordial waters that covered most of the earth. Stories about fish and about amphibians, about reptiles and strange bird-like creatures are very common. The names of the authors of these stories have been forgotten, but the stories themselves and the wisdom they contain are remembered to this day. For instance the snakes which appear in these stories are shown not as evil and venomous but often as wise and beautiful. Birds are swift messengers of divine beings. The story of Matsya, the fish, is really the story of the preservation of life in the battle for the survival of the fittest. Matsya is a tiny fish in constant danger of being destroyed and swallowed up by larger and stronger creatures. But Matsya is swift-thinking and manages to cleverly escape death, and eventually is protected and cared for by intelligent and compassionate Man (Manu). Eventually Matsya who is no other than Vishnu himself, the Divine Being and the Preserver, returns to his rescuer Manu and helps him save himself and the earth from total destruction during a mighty natural calamity.

Similarly there is the story of Jaratkaru, the Snake princess who loved a wise human being and whose son Astika, half-snake half-human meets the human side of his family and persuades them to stop their violence on snakes. And there is the slow and steady tortoise who makes no sound and little movement—the tortoise is thought of as the support of the earth, a creature that will perhaps last after all life on our planet has come to an end. At a time when earthquakes and volcanoes ripped open the earth because of the rivalry and competitive wars fought by the gods and demons, it was Kurma, the Tortoise who carried the planet on his mighty back. Kurma, like Matsya was no other than Vishnu, the Preserver.

We should emulate the example of the great *rishi* Chyavana. During his twelve-year penance under water, he became very fond of the aquatic living things surrounding him. One day, he was shocked to see some fishermen catching and killing the fish that he had grown to love. He was so furious that he declined to even accept the king's offer of his kingdom as a token of repentance.

We must befriend and look after the wonderful variety of plants and animals which are our companions and a source of delight and wonder.



Sea urchin

Starfish

Taran Comprint, Ahmedabad and printed at Diamond Lithographers, New Delhi